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Market Discipline Through Credit Ratings and
Too-Big-To-Fail in Banking?



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Market discipline through credit ratings and Too-Big-to-Fail in banking*

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Abstract

Do credit ratings help enforce market discipline on banks? Analyzing a uniquely comprehensive dataset consisting of 1,081 rating change announcements for 154 international financial institutions between January 2004 and December 2015, we find that rating downgrades for internal reasons, such as adverse changes in the operating performance or capital structure of banks, are associated with a significant CDS spread widening. However, this widening only occurs for banks that are *not* perceived as to be Too-Big-to-Fail (TBTF). Our findings question the reliability of credit ratings as a tool to discipline TBTF banks and suggest that regulatory monitoring should remain the main mechanism for disciplining these banks.

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1. Introduction

Credit ratings play a significant role for banks as they provide important information on the overall riskiness of a bank to investors and its counterparties. If the rating of a bank is low, its refinancing costs will be high, while it may simultaneously lose business to other banks due to its high counterparty risk.¹ Therefore, having a comparatively high and stable rating is of great importance for any financial institution.

However, banks (not unlike any other rated entities) are often only partially able to influence their own credit rating. A bank's rating can, for example, be tied to the sovereign rating of the country (in which the bank has its main operations) due to the sovereign rating ceiling.² Moreover, a deteriorating economic environment or changes to the methodology CRAs use to rate financial institutions are also beyond the control of banks and may lead to adverse rating changes (e.g., King, Ongena and Tarashev, Forthcoming). Nevertheless, even though banks operate in a highly cyclical environment, they still have the ability to influence certain factors that determine their rating.

In this study, we therefore test whether market discipline is relevant for Too-Big-to-Fail banks and how implicit TBTF guarantees may affect credit default swap (CDS) markets in particular. Particularly in the context of market discipline, credit ratings play a major role because they factor into the calculation of capital requirements for interbank claims and serve as a benchmark for the internal rating approach (see e.g., Basel Committee on Bank Supervision, 2006, 2011). The immediate motivation for our study is that a bank that is considered systemically important, however,

¹ In this context, the ratings provided by credit rating agencies (CRAs) are seen as a tool to impose market discipline on banks (Billett, Garfinkel and O'Neal, 1998), which supplements regulatory discipline as one of the three pillars of financial sector regulation (e.g., Basel Committee on Bank Supervision, 2006, 2011).

² Standard & Poor's (S&P) and Moody's somewhat relaxed their country risk ceilings, effectively allowing firms to have higher ratings than the sovereign rating of their home country (see e.g., Moody's, 2015; Standard & Poor's, 2013). It is, however, still not a common occurrence.

may not need to make any adjustments even if it was downgraded for internal reasons, because changes to its credit rating may not matter much as a result of an implicit assumption by market participants that the bank will be bailed out by the government if there is a threat of bankruptcy (e.g., Hett and Schmidt, 2017).³

We use CRAs' credit rating announcements, i.e., rating downgrades or upgrades, as easily visible events to market participants, to investigate whether the creditworthiness of a bank is increasing or deteriorating. We analyze the reaction of the banks' CDS spreads, which are a direct measure of a bank's creditworthiness and default probability. The CDS market is viewed as one of the most prevalent channels through which new, credit relevant information can be transmitted and which contains unique firm information that is not captured by other markets (Lee, Naranjo, Veliloglu, 2018). Indeed, given its informed trading (Acharya and Johnson, 2007), any deterioration or improvement in a bank's creditworthiness should therefore immediately be reflected in a widening or tightening of the CDS spreads. Consequently, examining the CDS market as one of the most prevalent, market-based measures of credit risk offers valuable insights into the way market participants evaluate rating changes in light of potential TBTF considerations.

Prior research on the effect of rating change announcements on firms' CDS spreads generally documents a significant widening of CDS spreads as a result of credit rating downgrades.⁴ The majority of prior studies, however, does not focus on one specific industry or the financial sector in

³ TBTF was first acknowledged by the U.S. Comptroller of the Currency in 1984 following a U.S. Senate hearing when he defended the bailout of Continental Illinois by the Federal Deposit Insurance Corporation and the U.S. government. Since then, research on the existence, effects, and consequences of TBTF increased significantly (e.g., O'Hara and Shaw, 1990; Morgan and Stiroh, 2005; Brewer and Jagtiani, 2013).

⁴ For example, Hull, Predescu and White (2004), Norden and Weber (2004), Galil and Soffer (2011), Finnerty, Miller and Chen (2013), and Norden (2017). In contrast, for rating upgrades, the majority of prior studies fails to observe a significant CDS market reaction to rating upgrade announcements (Hull et al., 2004; Norden and Weber, 2004) and only more recent evidence points to a small, but significant, tightening of CDS spreads following a rating upgrade (Finnerty et al., 2013; Galil and Soffer, 2011).

particular, thereby neglecting the possibility that, for example, rating announcements for closely regulated banks may lead to different CDS market reactions. TBTF considerations are strongest in the banking sector and the expectation of a government bailout in case of financial distress may shape investors' reactions to downgrade announcements in particular. Especially for TBTF banks, rating downgrades may not serve as an appropriate channel through which market discipline can be exerted on banks given the existence of implicit TBTF guarantees by governments. As the studies of Rime (2005) and Ueda and Weder di Mauro (2013) document, the credit ratings of large banks are distorted as a result of TBTF considerations. As a consequence, the CDS spreads of TBTF banks may not widen appropriately following a rating downgrade due to expectations of government bailouts. Therefore, studying the effect of rating changes on the CDS spreads of financial institutions will offer valuable insights into the efficacy of rating changes as an appropriate channel through which market discipline is enforced on financial institutions. A potential break down of one of the mechanisms of market discipline inevitably questions the viability of credit ratings as an appropriate tool to discipline banks for excessive risk taking and should consequently be a concern to regulators and policy makers alike.

We analyze the effect of TBTF considerations on credit rating changes for financial institutions in two steps. First, we examine how banks' CDS spreads react to rating change announcements, depending on the reason of the rating change. It may well be that the CDS spread reactions differ if the rating changes are due to external reasons outside the direct control of the bank, such as a deteriorating economic climate or changes to the CRA's rating methodology, or internal reasons within the purview of a bank, such as a poor operating performance. Second, we investigate whether TBTF benefits exist in debt capital markets by differentiating between CDS spread reactions of TBTF and non-TBTF banks to rating downgrades. Rating downgrades may have a limited

effect on the perceived creditworthiness of TBTF banks, rendering downgrades an ineffective mechanism for the enforcement of market discipline.

We construct a uniquely comprehensive dataset consisting of 1,081 rating change announcements, 782 rating downgrades and 299 rating upgrades, for 154 international financial institutions between January 2004 and December 2015. The analysis of the CDS spread reaction to rating changes reveals that only rating downgrades due to internal reasons, such as adverse changes in the operating performance or capital structure of the bank, are associated with a large and significant widening of CDS spreads. For TBTF banks, however, rating downgrades attributed to internal reasons do not lead to any CDS spread changes, while a significant widening of CDS spreads is observed for non-TBTF institutions. The results also hold after controlling for other factors that may influence the CDS spread reaction to rating changes, such as a bank's initial rating or its leverage. The loading factors for the variables in the regression analysis suggest that, all else being equal, following a rating downgrade due to internal reasons, the CDS spread of a non-TBTF bank will widen approximately 67 basis points (bps) more than the CDS spread of a TBTF institution. This, for example, implies that for a non-TBTF bank with a letter rating equivalent to an A, the CDS spread will widen by roughly 86 bps, compared to 19 bps for a TBTF bank in case of a one notch rating downgrade. The results are robust to different methodology specifications, such as alternative empirical approaches, model specifications and time-varying changes in the regulatory environment.

Our findings make multiple contributions to the existing literature. First, we contribute to the empirical literature on TBTF by analyzing whether the effects of credit rating downgrades differ depending on the importance of banks. By investigating the CDS market reaction for TBTF and non-TBTF banks to credit rating changes, we go beyond investigating the effect of bank size on rating

levels (e.g., Völz and Wedow, 2011; Ueda and Weder di Mauro, 2013) and directly test whether size influences the market reaction itself. We document that TBTF banks, which are larger and more important, possess a comparative advantage in credit markets over their smaller peers. Third, and most importantly, by showing that TBTF banks' CDS spreads are not affected by rating downgrades, we present novel evidence that rating downgrades are not an appropriate mechanism through which market discipline can be enforced on banks. This breakdown in one of the mechanisms of market discipline questions the viability of credit ratings as a tool to curb banks' excessive risk taking and highlights the importance of regulatory discipline as the main mechanism for monitoring TBTF banks. Second, we add to prior research on the effects of rating announcements on the CDS spreads of firms (e.g., Hull. et al., 2004; Norden, 2017). By focusing exclusively on financial institutions, we are able to offer new insights into the importance of the reasons for rating announcements and how they affect the refinancing costs of firms.

The rest of this paper is structured as follows. Section 2 describes the data set and methodology and Section 3 presents the empirical results on the effect of rating changes on banks' CDS spreads, depending on the reason of the rating announcements. Section 4 provides an analysis of the differential impact of rating downgrades on the CDS spreads of TBTF and non-TBTF banks, while Section 5 provides several robustness tests, including a comparative analysis of the stock and bond market reactions. Section 6 concludes the paper.

2. Data and methodology

2.1 Sample construction

Our analysis is based on a global sample of banks with a long-term issuer rating by S&P, Moody's and/or Fitch with CDS spread data available through Thomson Reuters Composite EOD. Thomson Reuters offers data on CDS spreads beginning in 2004 and our analysis covers the 12-year time

period from January 2004 to December 2015.⁵ We focus our study exclusively on banks and banking related institutions (primary Standard Industry Classification (SIC) codes from 6000 to 6289 and SIC codes 6712 and 6733), as these firms are at the center of discussion with regard to TBTF policies. Using these criteria, we exclude all insurance carriers, real estate companies, non-bank holding companies, and other miscellaneous investment companies. This approach is in line with, among others, Ueda and Weder di Mauro (2013) and Gandhi and Lustig (2015). In total, we were able to retrieve CDS data for 234 different financial institutions from Thomson Reuters, of which 212 had a long-term issuer rating from at least one of the three major CRAs.⁶ We use the long-term issuer rating of banks, which combine standalone ratings and the probability of extraordinary sovereign support, as opposed to only the standalone ratings for two main reasons.⁷ First, King et al. (Forthcoming) find evidence that standalone ratings or refinements of these ratings have a limited effect at best on the all-in ratings of financial institutions. Second, Fitch revised its measurement scale in 2011, while S&P did not publish standalone ratings prior to the fourth quarter of 2011, raising potential comparability and data availability issues. Therefore, long-term issuer ratings are preferable for the purpose of this study. In a next step, we collected all the relevant press releases for each rating change from the website of the respective CRA.⁸

⁵ Mayordomo, Pena and Schwartz (2014) find some evidence that the CDS data quality can vary across different sources between January 2004 and March 2010. Yet, they nevertheless confirm that Thomson Reuters EOD is a viable source for CDS data. It should also be noted that the investigation period of Mayordomo et al. (2014) ends in March 2010, whereas ours extends well beyond that and ends in December 2015. In fact, more than half of our observations take place between 2011 and 2015.

⁶ Using this selection procedure implies that we use the CDS data for all banks available through Thomson Reuters EOD. This gives us the largest possible sample for our investigation and allows us to conduct a thorough analysis on the effect of credit rating changes on an international sample of banks.

⁷ The long-term issuer rating, also called the all-in-rating, combines a bank's standalone rating with the CRA's estimate of the probability and magnitude of extraordinary support, either by the bank's home country or its ultimate parent company. The standalone rating only aims at measuring a bank's intrinsic financial strength and therefore its ability and/or willingness to repay its debt. For a further discussion see also King et al. (Forthcoming).

⁸ Some of the relevant credit rating announcements for S&P were collected from the Alacra website (<http://www.alacrastore.com>).

We identified a total of 3,393 rating change and rating review announcements by S&P, Moody's and Fitch between the years 2004 and 2015. The total sample is split into 2,186 rating downgrade and rating review for downgrade announcements and 1,207 rating upgrade and rating review for upgrade announcements. Figure 1 shows the total number of rating downgrades and upgrades during our entire investigation period. On average, each bank in our sample receives approximately 7 downgrades and 4 upgrades over all three major CRAs, which equals one rating announcement every 7 months. The average time period between two announcements is 272 trading days with a median of 120 trading days. Most rating downgrades occur between the third quarter of 2008 and the second quarter of 2009, the height of the recent financial crisis. Prior to the crisis, upgrades occurred more frequently than downgrades and a spike in the number of upgrades can be observed during the second quarter of 2007, just before the start of the financial crisis. During the crisis, very few rating upgrades are observed. Following the crisis, still fewer rating upgrades than downgrades are observed. Moreover, the number of rating downgrades spiked again during the fourth quarter of 2011 and the second quarter of 2012, the height of the European sovereign debt crisis. Particularly Greek and Spanish banks were frequently downgraded, their average rating decreased by 7 and 5 notches, respectively. Since the third quarter of 2012, the number of downgrades appears to have stabilized. Figure 1 also shows that the average bank rating increased between 2004 and the first quarter of 2008 from A-/A3 to A/A2. However, following the financial crisis, the average rating decreased by more than two notches and stood at BBB+/Baa1 at the end of 2015. This is an indication that CRAs started to more carefully assess the credit risks of banks in the wake of the financial crisis and are now less willing to provide high credit ratings. This is in line with the findings of Dimitrov, Palia and Tang (2015) who show that after the Dodd-Frank act

CRAAs issue lower ratings. Moreover, the finding is also in line with the reputation model developed by Morris (2001), suggesting that CRAAs in the post-Dodd-Frank period may be more protective of their reputation. It is, however, noteworthy that the average rating of a non-US and non-European financial institution increased by roughly 1 notch during our observation period, possibly reflecting the increased importance of banks headquartered outside of the U.S. and Europe.

[Please insert Figure 1 around here]

Our starting sample contains all 3,393 rating review and rating change announcements by the three major CRAAs for our sample of 212 financial institutions. As the focus of the present study is on the CDS market reaction to rating change announcements, we drop all rating reviews from our sample in a first step. Next, all events are dropped for which CDS data is not available or not in sufficient quality during the estimation or event period. In a further step, we eliminate all events for which the reason for the rating change could not be properly determined. Finally, we exclude all events for which accounting data for the subsequent regression analyses are missing. This leaves us with a final sample of 1,081 rating change announcements for 154 different financial institutions, of which 28 are considered TBTF, from 36 different countries for our analysis: 782 rating downgrades and 299 rating upgrades (Table A.1 in the Appendix offers a detailed overview of the number of events by country and year).⁹ Table 1 provides an overview of the sample selection procedure.

⁹ TBTF appears to be universal phenomena and in this context national regulatory systems only play a subordinated role. The G-SIBs, for example, are comprised of the globally largest financial institutions, irrespective of their country of origin and regulation of these institutions goes beyond the national level. Furthermore, prior research also does not differentiate between different legal systems (e.g., Cubillas, Fernandez and Gonzalez, 2017; Ueda and Weder di Mauro, 2013), thereby acknowledging the universality of TBTF.

[Please insert Table 1 around here]

In line with Goh and Ederington (1993), Bannier and Hirsch (2010), and Imbierowicz and Wahrenburg (2013), we explicitly focus on the reason behind a rating announcement. We allocate the rating change announcements into either internal or external reasons. Both reasons are divided into three subcategories. Internal reasons are rating announcements due to changes in capital structure, operating performance, or M&As, while external reasons are a result of circumstances that are outside the direct control or influence of the bank. They are further divided into rating announcements due to changes in the macroeconomic or regulatory environment, adjustments to the sovereign rating, and changes in the methodology the CRA uses to assess the banks' ratings. We use 76 keywords that are frequently mentioned as a reason and sort them in order of appearance in the press release of the CRA (see also Table A.2 in the Appendix for a full list of all keywords by category). In case more than one keyword appeared in the press release, we follow Imbierowicz and Wahrenburg (2013) and assign the event to the first keyword mentioned in the press release and allocate the keywords to one of the six categories.¹⁰

Goh and Ederington (1993) divide rating announcements into two broad categories: deterioration or improvement in the firm's earnings and in actions or decisions that result in a change in the firm's leverage. Both categories are part of our internal reasons. We add rating change announcements because of merger activity to our internal reasons, as M&As are usually actively pursued by a firm and can affect the operating performance and capital structure of a company in multiple ways. In contrast, external reasons are a result of circumstance that are outside the direct control

¹⁰ If a press release did not explicitly include one of the keywords, the announcement was manually matched to the closest category. In case the announcement did not fit into any of the six categories, it was dropped from the sample (see also Table 1). This, however, happened only in 4 cases for rating downgrades.

or influence of the bank. These include an improvement or deterioration in the economic climate or changes in the overall regulatory framework, adjustments to the CRAs' rating methodology, and rating changes due to adjustments in the sovereign rating of the country in which the bank has its main operations or headquarter.

Table 2 provides an overview of the different reasons for the rating change announcement by year. 373 (35%) of the events in the sample are due to internal reasons, while 708 (65%) events are due to external reasons. This already shows that approximately two thirds of the rating change announcements are outside of the direct control of the bank. Table 2 Panel A displays the number of downgrades. 540 downgrades are a result of external reasons, while the remaining 242 downgrades are due to internal reasons. Table 2 Panel B shows the number of upgrades by year. Approximately 50% of all upgrades occurred prior to the financial crisis, particularly during the years 2006 and 2007. This is in line with the observation in Figure 1 that the average bank rating underwent a pronounced increase during those years. Rating upgrades are largely driven by reasons outside of the direct control of the bank, as upgrades due to adjustments in the CRAs' rating methodology and due to sovereign rating changes account for 153 of the 299 upgrades in our sample. Overall, the distribution of rating changes by year and reasons underlines the highly cyclical business of firms operating in the financial sector.

[Please insert Table 2 around here]

2.2 Empirical methodology

We use CDS spreads to determine the debt market reaction to rating announcements. CDS are a viable, market-based measure of the credit risk of firms and are extensively used by investors in order to hedge and invest in credit risk (Gilchrist and Zakrajsek, 2013). One of the main advantages of CDS is the ease with which to buy credit protection compared to shortening bonds. In addition,

prior research documents that information in the CDS market tends to spill over to bond spreads (Blanco, Brennan and Marsh, 2005), that CDS generally reflect new information more quickly than bond markets (e.g., Longstaff, Mithal and Neis, 2005) and also contain unique information not readily present in other markets (Lee et al., 2018).

In line with the vast majority of existing literature, we use the five-year tenor senior CDS mid spread in U.S. dollars (e.g., Longstaff et al., 2005; Jorion and Zhang, 2007; Demirgüç-Kunt and Huizinga, 2013) as it is by far the most commonly traded and liquid tenor in the market.

We analyze CDS spread changes as a measure for the daily change in the credit risk of a bank as the goal of this study is to document the changes in banks' CDS spreads subsequent to rating announcements. Following, among others, Jorion and Zhang (2007) and Norden (2017), we use daily absolute spread changes $\delta_{i,t}$ for bank i at time t :

$$\delta_{i,t} \equiv CDS_{i,t} - CDS_{i,t-1}, \quad (1)$$

where $CDS_{i,t}$ is the CDS spread in bps, for bank i 's CDS on day t . Rating announcements for banks are frequently clustered and heavily depend on the sovereign rating of the bank's country of origin.¹¹ We therefore refrain from using a benchmark adjusted model and estimate adjusted CDS spread changes on the basis of a constant spread change model. This model has the distinct advantage that we do not need a proxy for a market portfolio, thereby avoiding any potential biases

¹¹ See for example the downgrade of Greece banks following the rating downgrade of Greece (https://www.moodys.com/research/Moodys-to-review-six-Greek-banks-for-possible-downgrade--PR_198269). In addition, in light of the recent financial crisis and the European sovereign debt crisis, CRAs made adjustments to the methodology they use for rating financial institutions. See for example https://www.moodys.com/research/Moodys-reviews-global-bank-ratings--PR_321005 for adjustments to the rating methodology Moody's uses to assess the credit ratings of banks.

in calculating the benchmark if multiple firms are affected simultaneously. We follow Handjinicolaou and Kalay (1984) for bond spreads and Schäfer, Schnabel and Weder di Mauro (2016) for CDS spreads and estimate a constant spread change model using:

$$ASC_{i,t} \equiv \delta_{i,t} - \mu[\delta_{i,t}|\Omega_T], \quad (2)$$

where $ASC_{i,t}$, $\delta_{i,t}$ and $\mu[\delta_{i,t}|\Omega_T]$ are the adjusted, realized, and normal spread changes, respectively, for bank i 's CDS on day t . The normal spread change is the expected spread change conditional on the information set Ω_T and is estimated using a 120-trading day period prior to the first day of the event window:

$$\mu[\delta_{i,t}|\Omega_T] = \overline{\delta_{i,t}} = \frac{1}{120} \sum_{i=-11}^{-130} \delta_{i,t} \quad (3)$$

We calculate cumulative adjusted CDS spread changes (CASCs) by adding daily ASCs from day τ_1 to τ_2 . CASCs are computed for each day of the event window $[\tau_1; \tau_2]$ in $[-10\dots,+10]$. In order to test whether the mean CASCs differ significantly from 0, we use the standard cross-sectional parametric t -test as well as the nonparametric Wilcoxon signed-rank test. The difference between two samples are tested using the two sample t -test and the Mann-Whitney U test.

3. The effect of credit rating changes on banks' CDS spreads

Table 3 shows the results for rating downgrade announcements. For the entire sample of rating downgrades, a significant widening of CDS spreads can be observed, particularly during the $[-5;+5]$ day event window (Table 3 Panel A), with the mean CASC amounting to 12.32 bps. It is, however, noteworthy that this widening can only be observed for the mean CASC, while the median CASC is negative and the Wilcoxon signed-rank test remains insignificant.

[Please insert Table 3 around here]

By further dividing the sample into downgrade announcements due to internal reasons (Table 3 Panel B) and external reasons (Table 3 Panel C), deeper insights can be gained into the way bank credit rating downgrades are evaluated. Downgrades as a result of internal reasons lead to a highly significant widening of CDS spreads of 44.20 bps during the [-10;+10] day event window and 50.53 bps during the [-5;+5] day event window, respectively. The median CASCs are lower, but still positive and the *t*-statistic as well as the Wilcoxon signed-rank test indicate high levels of significance. Rating downgrades due to external reasons, in contrast, are associated with a significant tightening of CDS spreads during the [-10;+10] day event window, as the mean and median CASC of -10.19 bps and -4.81 bps document. This tightening is, however, small compared to the widening of CDS spreads observed following downgrades due to internal reasons. There is some evidence that in the case of external reasons for downgrade, a large part of the adjustment to the CDS spread takes place during the [+1;+5] day event window following the downgrade announcement, indicating that CDS market participants take some time to incorporate the new information into the banks' CDS spreads.¹² Moreover, the difference between rating downgrades due to internal and external reasons is highly significant for almost all event windows (Table 3 Panel D).

Table 4 shows the CDS event study results for rating upgrade announcements. For the entire sample of rating upgrades, a small, but significant tightening of CDS spreads can be observed. However, compared to rating downgrades, the effect of rating upgrades is low and no significant CDS spread changes can be observed during the [-10;+10] day event window, suggesting that rating upgrades have little to no impact on banks' CDS spreads.

¹² The tightening of CDS spreads appears to be largely driven by downgrades following changes in the methodology used by the CRAs (see also Figure A.1 in the Appendix). In this instance it may be that the rating downgrades are less severe than initially communicated by the CRAs and anticipated by market participants.

Splitting the sample of upgrade announcements into upgrades due to internal reasons (Table 4 Panel B) and external reasons (Table 4 Panel C) again offers deeper insights. Contrary to expectations, rating upgrades as a result of internal reasons lead to a significant widening of the banks' CDS spreads. Simultaneously, the results also show a significant tightening of CDS spreads on the announcement day of the rating upgrade. However, as the change in the mean and median CASC is less than 1 bp, the effect is negligible. In contrast, rating upgrade announcements due to external reasons are associated with a significant tightening of CDS spreads, concentrated on the $[-5;+5]$ and $[-1;+1]$ day event windows with a mean CASC of approximately -3 bps. These CDS spread changes, however, are still small and again indicate the limited impact that rating upgrades have on the CDS spreads of financial institutions. The difference in the CASCs between upgrade announcements due to internal and external reasons are only significant during the $[-5;+5]$ day event window (see Table 4 Panel D).¹³

[Please insert Table 4 around here]

Overall, credit rating downgrades of banks lead to a large, significant widening of CDS spreads, while rating upgrades are only associated with small and at best weakly significant tightening of CDS spreads. This finding, and the asymmetric nature of the CDS market reaction to rating change announcement, is in line with large parts of the literature (e.g., Hull et al., 2004; Finnerty et al., 2013). Figure 2 illustrates this result. The results, however, also document that the widening of CDS spreads following rating downgrades is entirely driven by downgrade announcements due to

¹³ Table A.3 and Table A.4 in the Appendix provide an overview of the CDS market reaction to downgrades and upgrades, respectively, divided into the six different reasons.

internal reasons (see also Figure 2 Panel A). Rating upgrade announcements due to external reasons are associated with a small, but significant tightening of CDS spreads, while rating upgrades for internal reasons lead to a small widening of CDS spreads (see also Figure 2 Panel B). Yet, compared to the CDS market reaction to rating downgrades, the reaction to rating upgrades can be considered to be negligible.¹⁴

[Please insert Figure 2 around here]

4. The impact of rating downgrades on the CDS spreads of Too-Big-to-Fail versus regular banks

The previous section clearly demonstrated that only rating downgrade announcements attributed to internal reasons lead to clear CDS market reactions. The CDS market reaction to rating upgrades is negligible compared to downgrades. We therefore forgo a deeper analysis of the effect of rating upgrades and largely concentrate our further examinations on the impact of TBTF rating downgrade announcements. Focusing on internal reasons has the additional advantage that these downgrade announcements relate to a single bank only, which allows for clearer conclusions with regard to the effect of TBTF consideration on the CDS spread of financial institutions. Rating change announcements due to external reasons usually affect a large number of banks simultaneously, which in turn may blur results and therefore not allow for a clear isolation of the effect of TBTF. In particular, we anticipate that rating downgrade announcements for banks that are considered TBTF will have little to no impact on the CDS spreads of these institutions, as market participants

¹⁴ Figure A.1 in the Appendix provides for a graphical illustration of the results by the six different reasons for rating changes.

are likely to expect a government bailout in case the bank faces bankruptcy. For non-TBTF banks, on the other hand, we expect a significant widening of CDS spreads.

In this context, the definition of TBTF is important in order to properly assess the effect of TBTF considerations on rating changes. Prior research that focused exclusively on the U.S. frequently used the 11 largest banks by assets to define TBTF banks (e.g., O'Hara and Shaw, 1990; Morgan and Stiroh, 2005). For international samples, the more recent definition of Global Systemically Important Banks (G-SIBs)¹⁵ is often used (e.g., Bongini, Nieri and Pelagatti, 2015; Moenninghoff, Ongena and Wieandt, 2015). The size of a bank's total assets is clearly important to be perceived as being TBTF, and several studies that use samples consisting of international banks (e.g., Demirgüç-Kunt and Huizinga, 2013; Cubillas et al., 2017) focus on some measures based on total assets. As we likewise have an international sample of financial institutions from 36 different countries, we define TBTF by the total assets of a bank in its country of origin relative to other banks in that country. In particular, we treat a bank as being TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating change. We believe it is reasonable to assume that a national government would not allow one of the three largest financial institution in the country to fail, as the repercussion for the financial system are potentially too severe, thereby justifying a government bailout. This definition of TBTF is also used by Cubillas et al. (2017).

4.1 CDS event study results

Table 5 presents the results of the CDS event study comparing rating downgrades due to internal reason for TBTF and non-TBTF banks. It can clearly be seen that the CDS market reaction to

¹⁵ G-SIBs and Systemically Important Financial Institutions (SIFIs) are frequently used interchangeably, but the latter term is generally defined somewhat more broadly and includes other financial intermediaries, such as insurance companies and market infrastructure providers.

rating downgrades for TBTF banks is small and largely insignificant (see Table 5 Panel A). There appears to be a weakly significant widening in CDS spreads for TBTF banks during the $[-30;-11]$ day event window, which may indicate some information leakage, but the spread changes are comparatively small.¹⁶ In contrast, the CDS spreads of non-TBTF banks undergo a significant widening during almost all event windows (see Table 5 Panel B). The mean CASC amounts to 69.43 bps and 74.12 bps during the $[-10;+10]$ and $[-5;+5]$ day event window, respectively. There appears to be some information leakage prior to the official rating downgrade announcement, as the CASC during the $[-5;-1]$ day event window is significant, but there are no significant spread changes during the $[-30;-11]$ day event window, suggesting that there is little leakage overall. Moreover, the reaction on the announcement day and during the $[+1;+5]$ event window are also highly significant. This suggests that CDS market participants are not able to properly assess the true effect of the rating downgrade prior to the actual downgrade announcement.

[Please insert Table 5 around here]

The difference between the CDS market reaction to rating downgrade announcements between TBTF and non-TBTF banks is also very pronounced (see Table 5 Panel C). With the exception of the announcement day and the $[-30;-11]$ and $[-1;+1]$ day event windows, respectively, the mean and median CASC are significantly lower for TBTF banks than for non-TBTF banks. The difference in the mean CASC amounts to -76.30 bps during the $[-10;+10]$ day event window, giving a strong indication that CDS market participants distinguish between banks that are likely to receive a bailout by their country's government in case they experience financial distress and those that

¹⁶ We also calculate the CASC for the $[-30;-11]$ day event window in this section and several of the following sections in order to alleviate concerns with regard to potential leakage. For this event window the expected spread changes $\bar{\delta}_t$ are computed using a 120-trading day period from $t=-150$ to $t=-31$.

are unlikely to receive such a treatment. The assumption of TBTF status by CDS market participants leads to a very subdued market reaction for TBTF banks, providing evidence that the market discipline mechanism, which downgrades by CRAs should provide, is actually not functioning properly or not present at all.¹⁷

Figure 3 Panel A illustrates the CDS spread development for TBTF and non-TBTF banks during the [-30;+10] day event window for internal downgrade reasons. There is a very pronounced widening of CDS spreads for non-TBTF banks, starting approximately five days prior to the rating downgrade announcement and ending five days following the rating announcements. In stark contrast, the CDS spreads of the TBTF banks remain comparatively stable and show no distinct pattern overall.¹⁸ Figure 3 Panel B shows the CDS spread development for external downgrade reasons divided into TBTF and non-TBTF banks. It can be seen that the tightening of CDS spreads is driven by non-TBTF banks following the downgrade announcements. This tightening may be due to market participants anticipating multi-notch downgrades, which subsequently did not occur.

[Please insert Figure 3 around here]

4.2 Regression results

The observed CDS spread changes following rating downgrade announcements may be driven by more factors than just TBTF considerations. In order to account for these factors, we run several regressions to determine the impact of different definitions of TBTF on our results and of other

¹⁷ Table A.5 in the Appendix shows the difference between TBTF and non-TBTF banks for rating downgrades due to external reasons. For external reasons, the tightening of CDS spreads is largely driven by non-TBTF banks, while for TBTF banks largely insignificant and negligible reactions are observed.

¹⁸ The results also hold when splitting the sample of rating downgrades for internal reasons into different regions and countries (see Figure A.2 in the Appendix). Noting the comparatively small sample sizes, the difference in absolute spread changes between TBTF and non-TBTF banks varies between the different regions and countries and downgrades appear to matter more to TBTF banks in smaller countries (e.g. the Netherlands and Italy).

rating-, event-, and bank-specific variables, including the most prominent variables used in prior literature. The ordinary least squares (OLS) regression takes the following form:

$$CASC_{i, [\tau_1; \tau_2]} = \alpha + \beta TBTF_{i,p} + \gamma TBTF_{i,p} \times INTERNAL_{i,p} + \delta Y_{i,p} + \lambda X_{i,p} + \psi Z_{i,p} + \varepsilon_i \quad (4)$$

where $CASC_{i, [\tau_1; \tau_2]}$ is the dependent variable, which is either the bank i 's CASC during the $[-10; +10]$ ($CASC_{i, [-10; +10]}$) or $[-5; +5]$ ($CASC_{i, [-5; +5]}$) event window. The independent variables are divided into TBTF-related variables, rating-specific variables, event-specific variables, and bank-specific variables. The TBTF-related variables include $TBTF$, a binary variable equal to 1 if a bank was among the three largest banks in its country of origin as measured by total assets at the end of the year prior to the rating change announcement (which is our default TBTF definition), and equal to 0 otherwise.¹⁹ As alternative definitions for TBTF, we use the variables $TBTF1$ and $TBTF5$, both also binary variables that take the value of 1 if the bank was the largest bank or among the five largest banks as measured by total assets in its country of origin at the end of the year prior to the rating change announcement, respectively, and take the value of 0 otherwise. In addition, we included the interaction term $TBTF \times INTERNAL$ to test whether the CDS market reaction of TBTF-banks differs significantly from the one of non-TBTF banks and is our main variable of interest.

$Y_{i,p}$ is a vector of rating-specific variables that includes $INTERNAL$, a binary variable that takes the value of 1 if the rating downgrade is due to internal reasons, and 0 if the rating downgrade is due to external reasons, $RATING$, defined as the bank's rating prior to the rating downgrade on a 23 step numerical scale (AAA/Aaa=23, AA+/Aa1=22, ..., C and lower=1), $NOTCHES$, defined in line with Bannier and Hirsch (2010) as the absolute difference between the old and new rating

¹⁹ During our investigation period the composition of the three largest banks in each country is comparatively consistent and there are only few instances where a bank ceases to be TBTF according to our definition and is replaced by a different bank. These instances do not affect our results.

based on the 23 step numerical scale, *REVIEW*, which equals 1 if the rating change was preceded by a rating review, and equals 0 otherwise, and *INVESTMENT TO NON-INVESTMENT DOWNGRADE*, which equals 1 if the rating downgrade resulted in a non-investment grade status of the bank (e.g. BBB-/Baa3 and above to BB+/Ba1 and below).

$X_{i,p}$ is a vector of event-specific variables, including *S&P* and *FITCH*, both equal to 1 if the downgrade announcement was made by S&P or Fitch, respectively, and 0 otherwise, and *CRISIS*, equal to 1 if the event occurred between January 2008 and December 2009, the height of the recent financial crisis, and 0 otherwise.

$Z_{i,p}$ is defined as a vector of bank-specific variables that includes *OPAQUENESS*, which is defined similarly as in Morgan (2002) and Bannier, Behr and Güttler (2010): it takes the value of 0 if the bank has a rating by S&P, Moody's and Fitch, 1 if the banks has a rating by two of the three CRAs, and 2 if the bank is rated by only one CRA²⁰. As financial institutions are considered to be opaque compared to other firms (see e.g., Morgan, 2002; Hirtle, 2006), we introduce this variable to test whether differences in opaqueness matter. Further bank-specific variables are *ROA*, defined as the bank's return on assets (ROA) in the year prior to the rating announcement, *LEVERAGE*, defined as the ratio of total liabilities to total equity of the bank at the end of the year prior to event, *LIQUIDITY*, defined in analogy to Kapadia and Pu (2012) as the ratio of non-zero daily CDS spread changes to the total number of trading days during the 120-day estimation period,²¹ and *LIABILITIES/GDP*, which is a binary variable that is equal to 1 if the ratio of the bank's total liabilities divided by the GDP of the bank's country of origin in the year prior to the event exceeds

²⁰ Morgan (2002) and Bannier et al. (2010) use split ratings between the CRAs, while we differentiate between the number of available ratings as a proxy for opaqueness. However, we also ran the regression using split ratings and analyst coverage as measures of opaqueness. The results remain unchanged.

²¹ Further tests showed that there is no significant difference in the liquidity measure between estimation period and the event window or between TBTF and non-TBTF banks.

0.5, and 0 otherwise. This variable controls for the systemic importance of a bank and for potential to Too-Big-to-be-Rescued considerations (see e.g., Völz and Wedow, 2011; Cubillas et al., 2017). The balance sheet data and a bank's ROA are taken from Bankscope and GDP data is obtained from the World Bank database. Additional bank-specific variables include *GOVERNMENT*, which is a binary variable that takes the value of 1 if the bank is a policy bank or the government holds significant stake in the bank (e.g., Royal Bank of Scotland following a capital injection by the British government in October 2008), and 0 otherwise, *IB*, which is equal to 1 if the bank's first two digits of the SIC code start with 62, and 0 otherwise, and *EU*, equal to 1 if the firm's head-quarter is located in Europe, and 0 otherwise. The variable *IB* essentially captures investment banks and asset managers, while *EU* accounts for the fact that European governments provided blanket guarantees to depositors and creditors of ailing financial institutions during the crisis, potentially reinforcing existing TBTF considerations.

Table 6 shows the regression results.²² Models 1 through 3 show the regression results using the [-10;+10] day CASC of bank *i*, while Models 4 to 6 show the results using the [-5;+5] day CASC. The interaction term *TBTF* \times *INTERNAL* is negative and highly significant in all model specifications, providing robust evidence that the CDS spreads of TBTF banks are considerably less affected by rating downgrades than those of non-TBTF banks. It is also noteworthy that the effect of TBTF is most pronounced when using the variable *TBTF1*, as the coefficient for this variable is larger compared to the coefficients for *TBTF* and *TBTF5*. In line with expectations, the more banks are included in the definition of TBTF, the lower the coefficient, with the coefficient for

²² The descriptive statistics for the variables used in the regression analyses are presented in Table A.6 in the Appendix. We also ran the same regressions only using the sample of 242 observations for internal reasons. The results are presented in Table A.7 in the Appendix and further support the results for the overall sample.

TBTF5 \times *INTERNAL* generally being the lowest, showing that only the largest banks in a country benefit most from TBTF considerations.

The rating-specific variables also have a significant influence on the observed CDS spread changes. The coefficient for *INTERNAL* is highly significant and positive in all models, further confirming that rating changes due to internal reasons lead to a significant widening of CDS spreads for non-TBTF banks (this is also in line with the CDS development observed in Figure 3 Panel A). Furthermore, the coefficient for *RATING* is negative and significant in all model specifications, indicating that a higher rating is associated with lower CDS spread changes. In addition, the coefficient for the variable *REVIEW* is likewise negative in all model specifications, but only significant in the first three model specifications. These estimates show that a rating review prior to the rating downgrade announcement leads to a significantly lower CDS market reaction, suggesting that CDS market participants may have anticipated the rating change. The coefficient for *NOTCHES* is positive and significant in all model specifications. In line with expectations, rating downgrades over several notches lead to a more significant widening of CDS spreads. In contrast, the variable *INVESTMENT TO NON-INVESTMENT DOWNGRADE* is not significant in any of the model specifications.

[Please insert Table 6 around here]

Among the event-specific variables, only the coefficient for *CRISIS* is significant in Models 4 through 6. The positive sign of the coefficient documents that CDS spreads of financial institutions widened significantly if the rating downgrade occurred during the recent financial crisis.²³ The

²³ Instead of the *CRISIS* variable we also ran the regressions with year fixed effects. The results remain qualitatively the same.

coefficients for the other event-specific variables lack significance, indicating that the CRA that announced the downgrade does not influence the observed CDS spreads surrounding a rating change.

With respect to the bank-specific variables, the coefficient for the variable *LIABILITIES/GDP* is positive and significant in several of the regression models. This provides some evidence that Too-Big-to-be-Rescued considerations may also have an effect on CDS spreads, as a government bailout may not be possible in case of very large banks. In addition, the variable *EU* is negative and at least weakly significant in all model specifications, indicating that European banks' CDS spreads are less affected by rating downgrades than those of other international financial institutions. This result suggests that market participants anticipate that European banks are more likely to receive a bailout in case they face financial difficulty. This expectation was actually fulfilled during the financial crisis, as European governments provided blanket guarantees to depositors and creditors to failing European financial institutions or those facing severe funding and liquidity shortages.²⁴ The other bank-specific variables have no influence on the observed CDS spread changes, as their coefficients are insignificant.²⁵

Overall, TBTF considerations appear to have a significant effect on CDS spread changes surrounding credit rating downgrades, even after controlling for other potential influence factors. This provides further evidence that market discipline mechanisms, such as credit rating downgrades, do not appear to work for financial institutions that are perceived to be TBTF and that markets assume

²⁴ Even in 2017, almost a decade after the end of the financial crisis, particularly European governments still prefer to bail out financial institutions rather than letting them go bankrupt, even if they are not TBTF (e.g., Italy in 2017 (Financial Times, 2017)).

²⁵ We also ran the regressions dropping all observations where the variable *GOVERNMENT* is equal to 1, as banks with partial government ownership may be regarded as TBTF simply due the government's involvement. The results are largely unchanged.

implicit government guarantees. Even if the creditworthiness of these institutions deteriorates and their credit rating is lowered, this does not lead to a corresponding widening in CDS spreads, giving TBTF banks a clear advantage over non-TBTF banks in refinancing and funding operations. Therefore, the enforcement of regulatory discipline appears to be of particularly importance for TBTF banks. Nonetheless, some of the rating-specific variables, such as the number of notches a rating was downgraded, rating review announcements prior to the rating change, and the bank's prior rating, still possess a significant influence on CDS spreads. In contrast, event-specific and bank-specific variables have a limited impact at best on the observed CDS spread changes surrounding rating downgrades.²⁶

5. Robustness tests

5.1 Stock and bond market reactions

We conduct an equity and bond event study to test whether these markets react in a similar fashion to the CDS market to bank rating changes.²⁷ The results of the stock and bond event study are shown in Table 7 and Table 8, respectively. The stock event study documents for the sample of 606 events that rating downgrades are generally perceived as negative events and that downgrades due to internal reasons lead to more pronounced negative reactions than those for external reasons. This corroborates the results of the CDS event study. Further differentiating downgrades due to internal reasons into those for TBTF and non-TBTF banks shows that the reaction is similar, even

²⁶ We also ran the regression removing the countries with the least observations from our sample in order to compare TBTF and non-TBTF firms in the same country as there may not be enough counterfactual non-TBTF firms with rating downgrade information in smaller countries. We drop the observations from Kazakhstan (3 observations), Denmark (2), Canada, Norway, Russia, Korea, Turkey (1 each) from our sample and repeated the OLS regression. We find that the results remain qualitatively the same.

²⁷ Compared to the analysis using CDS spreads, the number of events is lower for the stock and bond event studies as not all sample banks are listed on a stock exchange and not all banks had bond data in sufficient quality available. For reasons of brevity, the stock and bond event study methodologies are described in more detail in Appendix B.

though the overall stock price development is less negative for TBTF banks than non-TBTF banks during the $[-10;+10]$ day event window. The negative returns indicate that stockholders may benefit less from potential TBTF considerations, as debt and credit providers are usually the direct beneficiaries of a bailout. In addition, the results indicate that the stock market reaction is largely confined to the short term event windows as only these event windows show significant returns.

[Please insert Table 7 around here]

The results of the bond event study for the sample of 524 events are presented in Table 8 and show that rating downgrades are generally perceived to be negative events, as bond prices experience a small but significant drop in value. This further supports the results of the CDS event study. Differentiating the sample of downgrades due to internal reasons again into TBTF and non-TBTF banks shows that there is no meaningful bond reaction for TBTF banks during the $[-10;+10]$ day event window, while for non-TBTF banks a significant decline in bond prices can be observed. The difference is significant for the $[-5;+5]$ day event window. This result provides further confirmation of the reaction observed in the CDS market and offers additional support that particularly debt and credit markets take TBTF considerations into account.

[Please insert Table 8 around here]

The results for the stock and bond event study are graphically illustrated in Figure 4. The graphics show that stock as well as bond markets react to rating downgrades, particularly if they are due to internal reasons. Furthermore, the difference between TBTF and non-TBTF banks is persistent and in line with the observations of the CDS market. Therefore, TBTF considerations appear to play an important role in all three markets, whereby TBTF considerations are more prevalent in the CDS and bond market than the stock market.

[Please insert Figure 4 around here]

5.2 CDS market reaction to rating review announcements

Rating changes are usually carefully deliberated by CRAs and their ratings are supposed to look through the business cycle to ensure a certain degree of rating stability (Löffler, 2004). This, however, raises concerns with regard to the timeliness of credit rating changes. In this context, rating reviews allow CRAs to provide market participants with more timely information with respect to the creditworthiness of a firm, without resorting to direct rating changes (Boot, Milbourn and Schmeits, 2006).²⁸ Therefore, in order to alleviate concerns with respect to the timeliness of rating changes, we also look at the effect of rating review announcements on banks' CDS spread changes.²⁹

To obtain our sample for rating reviews, we start with the 1,029 rating review announcements that we collected from the websites of the three major CRAs and employ the same selection procedure as described in Section 2.1. We focus on rating reviews for downgrades, which leaves us with a final sample of 446 review announcements.

For the entire sample of rating reviews for downgrade, a significant widening of banks' CDS spreads can be observed (see Table A.9 in the Appendix). Splitting the sample into reviews for downgrade due to internal reasons) and external reasons leads to similar results as for the respec-

²⁸ The three major CRAs, S&P, Moody's, and Fitch use different terminologies to describe the rating review process: S&P places a firm on "CreditWatch", while Moody's places a firm's rating on "Watchlist", and Fitch on "Rating Watch".

²⁹ Prior research shows that CDS spreads widen following rating reviews for downgrade, analogous to rating downgrades, with most studies finding that review announcements have a similar effect to actual rating downgrades (see e.g., Hull et al., 2004; Norden and Weber, 2004; Galil and Soffer, 2011). For rating reviews for upgrade, the results are ambiguous, with Hull et al. (2004) and Norden and Weber (2004) failing to observe significant CDS market movements following rating reviews for upgrade, while Galil and Soffer (2011) document that rating reviews for upgrade lead to a significant tightening of CDS spreads.

tive rating downgrade announcements. Our prior result that CDS market participants react differently to rating announcements attributed to internal and external reasons is confirmed (see also Figure A.3 in the Appendix). The reaction to rating review for downgrade announcements, however, is overall less pronounced than for *actual* downgrade announcements.

5.3 Alternative methodologies and model specifications

We use multiple methodology modifications to further validate our results. As an alternative to the CDS event study methodology described in Section 2.2, we use benchmark adjusted CDS spread changes, an empirical set up that follows Hull et al. (2004), Jorion and Zhang (2007), and Norden (2017). This methodology adjusts the observed CDS spread changes by deducting the changes of a CDS spread index of the same rating class as the bank's initial rating using the equation:

$$ASC_{it} = (CDS_{i,t} - CDS_{i,t-1}) - (I_t - I_{t-1}) \quad (5)$$

where ASC_{it} is the adjusted CDS spread change of bank i on day t , $CDS_{i,t}$ is the observed CDS spread of bank i on day t and I_t is the relevant CDS spread index for the rating class on day t .³⁰ This methodology is well suited for internal reasons, as these rating announcements focus on one bank only, thereby avoiding distortions in the benchmark index due to multiple banks being affected simultaneously, as often happens for external reasons. We therefore limit our examination to rating downgrades due to internal reasons. The results are line with those described in Section

³⁰ The daily CDS spread index corresponds to the equally weighted cross-sectional mean of all CDS spreads for each of the six letter rating classes AAA/AA, A, BBB, BB, B, and CCC or below, and is composed of the CDS spreads of all banks with available data through Thomson Reuters EOD and a long-term issuer rating of either S&P, Moody's, or Fitch, excluding the event firm. AAA and AA rated banks are combined into one rating class, due to the small sample size of these firms. Our approach with respect to the benchmark also implies that the benchmark for each event is composed of all banks that have a rating by the CRA that announced the rating change (e.g., rating announcements by Moody's are compared with a benchmark consisting only of banks with a rating by Moody's).

4.³¹ We again document that for TBTF banks rating downgrade announcements do not influence their CDS spreads, while the CDS spreads of non-TBTF banks widen significantly.

In addition, we test whether our results hold when using subordinated CDS spreads instead of senior ones. Even though, the five-year tenor is the most liquid trading segment in the CDS market, traders and bank supervisors may also focus on information contained in CDS spreads on subordinate bank debt given that they are more risk-sensitive. We find that our results are consistent when using the five-year subordinated CDS, as we only observe a significant market reaction for non-TBTF banks but not for TBTF ones.³²

With respect to our regression models, for the sub-sample of internal rating changes, we interact the TBTF variable with a set of other variables that are potential drivers of the observed CDS market reaction to test the robustness of the TBTF variable. This analysis aims to determine whether TBTF considerations are the “true” driver of the CDS market reaction to rating downgrades. To this end we interact *TBTF* with the standardized variables *BANKSIZE*, *RATING* and *LIQUIDITY*, as well as the variables, *SOVEREIGN RISK* and *CDS TRADER*. The variable *BANKSIZE* is defined as the banks total assets in billion U.S. dollars at the end of the year prior to the rating change and tests whether larger banks in general are more likely to be rescued.³³ The variable *SOVEREIGN RISK* is defined as GDP divided by total national debt of the bank’s country of origin and captures the possibility that countries with high levels of national debt may not be in a financial position to bail out a struggling bank. The variable *CDS TRADER* is a binary variable

³¹ The results for market reaction using the benchmark model are shown in Table A.8.

³² Given the limited data availability for subordinated CDS spreads, our sample for internal rating changes is reduced from 242 to 95 observations. Table A.10 provides the results using the five-year subordinated CDS.

³³ *BANKSIZE* can be used as a variable in our regression analysis as we define TBTF to be banks that are among the three largest banks in their country of origin in the year prior to the event. As a result, some large financial institutions are not considered TBTF because they are smaller than other banks in their country of origin, even though they may still be larger by assets than the three largest banks in another country.

equal to 1 if the bank was among the active CDS traders based on quotes submitted by dealers in Bloomberg and accounts for the possibility that large banks which are involved in the CDS market may try to mitigate any adverse effects to their CDS spreads prior to the rating announcement.³⁴ The results show for all model specifications that the coefficient for *TBTF* is statistically significant, negative and large, indicating that TBTF considerations are the actual driver behind the observed CDS market reactions (see Table A.11 in the Appendix). This further supports the notion that TBTF is the main driver of the CDS market reaction to downgrade announcements and suggests that the reaction of CDS market participants to rating downgrade announcements is driven to a large extent by TBTF assumptions.

5.4 Changes in the regulatory environment

Following the recent financial crisis, bank regulation was tightened, especially for large, international banks with a global footprint. On 4 November 2011 the Financial Stability Board (FSB) released a list of financial institutions whose failure would lead to severe repercussion in the global financial system and disrupt the global economy, the so-called G-SIBs. The official acknowledgment of the existence of TBTF institutions may have alleviated concerns around the threat that a failure of these institutions potentially pose for the global economy and hence, market discipline may play a more prominent role again.³⁵

We divide our examination period into two sub-periods, one prior to the official G-SIB announcement on 4 November 2011, the pre-G-SIB period, and one following the official announcement,

³⁴ We standardized each variable by deducting the mean value and dividing by the standard deviation of that variable. For binary variables, we only deducted the sample mean.

³⁵ We also split the sample into three different time periods: (i) from 2004 to 2007, (ii) from 2008 to 2009 and (iii) from 2010 to 2015 to test whether the results differ prior to the 2008 financial crisis, crisis period and the post-crisis period. The difference between TBTF and non-TBTF banks is consistent for all three time periods, but more pronounced during the crisis period (see also Figure A.4 in the Appendix).

the post-G-SIB period. We focus our investigation on the sample for internal reasons, which gives us a sample of 180 events in the pre-G-SIB period and 62 events in the post-G-SIB period.³⁶ It can be seen that CDS spreads widen significantly during both periods (see Table A.12 in the Appendix), even though the widening of CDS spreads is less pronounced during the post-G-SIB period. For TBTF banks, no significant CDS market reaction can be observed to rating downgrade announcements during both time periods. In contrast, for non-TBTF banks, a significant widening of CDS spreads can be observed during both investigation periods. Figure A.5 graphically illustrates the CDS spread development before and after the official G-SIB designation. It is noteworthy that the CDS market reaction appears less pronounced during the period following the official G-SIB designation, but there is no significant difference in the CDS market reaction of non-TBTF banks between the pre- and post-G-SIB period. The same observation is also made for TBTF banks. This suggests that there was no significant change in the market participants' perception of the importance of TBTF banks vis-à-vis non-TBTF banks during both periods.

6. Conclusion

We analyze the effect of credit rating changes on the CDS spreads of banks to test whether rating changes are an appropriate channel through which market discipline can be enforced. To this end, we construct a comprehensive sample of 1,081 credit rating change announcements between 2004 and 2015 for an international sample of financial institutions.

³⁶ Splitting the sample period results into the period prior to the leaked announcement of the G-SIB list on 30 November 2009 by the Financial Times (Financial Times, 2009) and the period following the leaked announcements leads to qualitatively similar results with 146 events for the period prior to the leaked list and 96 events following the leaked list. As a further robustness check, we control whether the Dodd-Frank act had a significant impact on our results. However, the results are similar to the ones reported.

Our analyses show that credit rating downgrades are overall associated with a large, significant widening of CDS spreads, while rating upgrades are associated with only a small tightening of CDS spreads. However, by further dividing our sample into the reasons for the rating change announcements, we find that the widening of CDS spreads following rating downgrade announcements is entirely driven by downgrades due to internal reasons, such as adverse changes in the operating performance or capital structure of the bank. Rating changes due to external reasons, such as changes in the economic environment, have almost no effect on banks' CDS spreads. In addition, even though a significant tightening of banks' CDS spreads can be observed surrounding rating upgrades, the effect is negligible compared to rating downgrades.

We further examine whether the rating downgrades due to internal reasons actually function as a proper channel for the enforcement of market discipline on financial institutions. Particularly for large banks, TBTF considerations may influence the reaction of CDS market participants to rating downgrade announcements, as government bailouts are anticipated if the financial position of these institutions deteriorates. In line with this reasoning, we find that CDS spreads of TBTF banks show no reaction to rating downgrade announcements. In contrast, non-TBTF banks experience a significant widening of CDS spreads surrounding rating downgrades. Even after controlling for other factors that potentially influence CDS spread changes, TBTF banks still experience significantly smaller spread changes than non-TBTF banks. Similar observations are also made for the stock and bond market. Therefore, TBTF banks have limited incentives to curb excessive risk taking as market participants do not appear to penalize these banks through a widening of CDS spreads, even if the bank's credit rating is lowered. Simultaneously, TBTF banks have significant refinancing and funding advantages over their non-TBTF peers.

These results provide evidence that for TBTF banks, rating downgrades are not an appropriate mechanism through which market discipline can be enforced on these institutions, given market participants' assumption of implicit government guarantees. This shows the importance of regulatory discipline as the main tool for controlling the risk taking of TBTF banks and raises the question whether markets can be expected to effectively discipline large, globally interconnected financial institutions.

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Table 1: Sample selection procedure

This table shows the sample selection procedure for the rating change announcements of banks during the investigation period from January 2004 to December 2015. The final sample is used for the empirical analyses of CDS spread changes throughout the main analyses.

	Downgrades	Upgrades	Total
Initial sample	2,186	1,207	3,393
Less rating review announcements	-762	-267	-1,029
Less no CDS data	-369	-527	-896
Less insufficient CDS liquidity	-153	-63	-216
Less “other” reasons	-4	-0	-4
Less missing accounting data	-116	-51	-167
Final sample	782	299	1,081

Table 2: Reasons for rating change announcements by year

This table shows the reasons for rating change announcements for the entire sample of 1,081 observations during the investigation period from January 2004 to December 2015. The reasons for bank rating changes are divided into internal reasons, which are within the control or influence of the firm, and external reasons, over which the firm has no influence. Internal reasons include rating changes as a result of changes in capital structure, operating performance, or M&A activity. External reasons include rating changes due to changes in the macroeconomic or regulatory environment, adjustments to the sovereign rating, and changes in the methodology the CRA uses to assess the ratings of banks.

Internal reasons			External reasons				
Year	Capital structure	Operating performance	M&A	Environment	Sovereign	Methodology	Total
Panel A: Rating downgrade announcements							
2004	0	1	0	2	0	0	3
2005	3	4	3	0	0	0	10
2006	0	0	0	0	0	0	0
2007	5	13	1	10	0	2	31
2008	14	38	5	30	6	0	93
2009	13	37	10	60	20	1	141
2010	2	10	2	22	22	0	58
2011	9	11	0	36	82	29	167
2012	8	8	0	47	57	4	124
2013	8	15	0	6	23	0	52
2014	9	6	0	6	17	0	38
2015	4	2	1	28	23	7	65
Total	75	145	22	247	250	43	782
Panel B: Rating upgrade announcements							
2004	3	4	0	2	1	0	10
2005	1	8	3	0	8	0	20
2006	8	21	12	1	5	0	47
2007	4	19	1	1	7	42	74
2008	0	1	5	0	4	0	10
2009	0	0	1	0	3	2	6
2010	1	5	0	0	10	0	16
2011	2	3	1	0	5	11	22
2012	6	0	1	1	3	0	11
2013	4	2	0	1	9	0	16
2014	4	7	1	1	10	2	25
2015	2	1	0	8	3	28	42
Total	35	71	25	15	68	85	299

Table 3: CDS market reaction to rating downgrade announcements

This table shows the results of the short-term CDS market reaction for the entire sample of 782 rating downgrade announcements (Panel A), divided into downgrade announcements due to internal reasons (Panel B) and external reasons (Panel C). The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating downgrade announcements due to internal and external reasons are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel D). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (<i>t</i> -value)	Wilcoxon (<i>Z</i> -score)	N	neg:pos
<i>Panel A: All rating downgrade announcements</i>						
[-10;+10]	6.641	-0.585	1.221	-0.862	782	405 : 377
[-5;+5]	12.315	-0.684	2.732***	-0.584	782	405 : 377
[-1;+1]	6.906	-0.448	2.274**	-0.691	782	421 : 361
[0;0]	3.488	-0.122	2.856***	0.105	782	414 : 368
[-5;-1]	6.600	0.231	2.624***	0.586	782	380 : 402
[+1;+5]	2.227	-0.139	0.750	-0.577	782	396 : 386
<i>Panel B: Rating downgrade announcements due to internal reasons</i>						
[-10;+10]	44.203	6.787	3.451***	3.189***	242	99 : 143
[-5;+5]	50.527	8.116	4.154***	4.199***	242	94 : 148
[-1;+1]	20.612	1.394	2.355**	2.075**	242	109 : 133
[0;0]	5.781	0.703	2.546**	2.541**	242	98 : 144
[-5;-1]	17.000	1.672	2.738***	1.963**	242	105 : 137
[+1;+5]	27.746	2.773	3.651***	4.040***	242	101 : 141
<i>Panel C: Rating downgrade announcements due to external reasons</i>						
[-10;+10]	-10.193	-4.070	-1.942*	-3.152***	540	306 : 234
[-5;+5]	-4.809	-3.837	-1.435	-3.686***	540	311 : 229
[-1;+1]	0.763	-1.305	0.393	-2.276**	540	312 : 228
[0;0]	2.461	-0.491	1.702*	-1.716*	540	316 : 224
[-5;-1]	1.939	-0.166	0.833	-0.657	540	275 : 265
[+1;+5]	-9.209	-1.059	-3.712**	-3.550***	540	295 : 245
<i>Panel D: Difference between rating downgrade announcements due to internal and external reasons</i>						
	Δ Mean CASC (bps)	Δ Median CASC (bps)	two sample <i>t</i> -test (<i>t</i> -value)	Mann Whitney U test (<i>Z</i> -Score)		
[-10;+10]	54.397	10.857	4.683***	4.410***		
[-5;+5]	55.336	11.953	5.792***	5.613***		
[-1;+1]	19.849	2.699	3.038***	2.951***		
[0;0]	3.320	1.194	1.257	3.091***		
[-5;-1]	15.060	1.838	2.780***	2.100**		
[+1;+5]	36.955	3.831	5.874***	5.356***		

Table 4: CDS market reaction to rating upgrade announcements

This table shows the results of the short-term CDS market reaction for the entire sample of 299 rating upgrade announcements (Panel A), divided into upgrade announcements due to internal reasons (Panel B) and external reasons (Panel C). The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating upgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating upgrade announcements due to internal and external reasons are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel D). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (<i>t</i> -value)	Wilcoxon (<i>Z</i> -score)	N	neg:pos
<i>Panel A: All rating upgrade announcements</i>						
[-10;+10]	0.896	0.253	0.962	1.925*	299	137 : 162
[-5;+5]	-1.302	-0.146	-1.787*	-1.103	299	160 : 139
[-1;+1]	-1.783	-0.223	-2.598***	-2.887***	299	174 : 125
[0;0]	-1.139	-0.064	-2.605***	-3.110***	299	165 : 134
[-5;-1]	0.338	0.177	0.791	1.858*	299	128 : 171
[+1;+5]	-0.501	-0.050	-0.827	-0.588	299	158 : 141
<i>Panel B: Rating upgrade announcements due to internal reasons</i>						
[-10;+10]	3.014	0.687	2.785***	2.440**	131	51 : 80
[-5;+5]	0.965	0.148	1.382	0.930	131	60 : 71
[-1;+1]	-0.290	-0.155	-0.835	-1.259	131	74 : 57
[0;0]	-0.519	-0.096	-2.817***	-2.640***	131	77 : 54
[-5;-1]	0.482	0.317	1.028	1.564	131	55 : 76
[+1;+5]	1.002	0.050	1.541	0.847	131	62 : 69
<i>Panel C: Rating upgrade announcements due to external reasons</i>						
[-10;+10]	-0.756	-0.159	-0.534	0.480	168	86 : 82
[-5;+5]	-3.069	-0.433	-2.645***	-2.177**	168	100 : 68
[-1;+1]	-2.948	-0.313	-2.487**	-2.679***	168	100 : 68
[0;0]	-1.622	-0.016	-2.124**	-1.854*	168	88 : 80
[-5;-1]	0.226	0.096	0.338	1.092	168	73 : 95
[+1;+5]	-1.673	-0.288	-1.773*	-1.481	168	96 : 72
<i>Panel D: Difference between rating upgrade announcements due to internal and external reasons</i>						
	Δ Mean CASC (bps)	Δ Median CASC (bps)	two sample <i>t</i> -test (<i>t</i> -value)	Mann Whitney U test (<i>Z</i> -Score)		
[-10;+10]	3.771	0.847	2.019**	1.215		
[-5;+5]	4.034	0.581	2.778**	2.273**		
[-1;+1]	2.657	0.158	1.929*	1.203		
[0;0]	1.104	-0.080	1.254	-0.431		
[-5;-1]	0.256	0.220	0.297	0.150		
[+1;+5]	2.674	0.338	2.205**	1.627		

Table 5: CDS market reaction to rating downgrade announcements due to internal reasons for TBTF and non-TBTF banks

This table shows the results of the short-term CDS market reaction for the sample of 242 rating downgrade announcements attributed to internal reasons, divided into downgrade announcements for TBTF banks (Panel A) and non-TBTF banks (Panel B). A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement. The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-30;-11], [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating upgrade announcements due to internal and external reasons are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel C). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (<i>t</i> -value)	Wilcoxon (<i>Z</i> -score)	N	neg:pos
<i>Panel A: TBTF banks</i>						
[-30;-11]	9.731	7.098	1.498	1.842**	80	33 : 47
[-10;+10]	-6.876	1.004	-0.908	-0.336	80	39 : 41
[-5;+5]	2.753	2.617	0.443	0.101	80	37 : 43
[-1;+1]	4.342	0.810	1.373	0.624	80	36 : 44
[0;0]	1.393	0.588	0.972	1.439	80	33 : 47
[-5;-1]	-4.384	-0.013	-1.448	-1.007	80	40 : 40
[+1;+5]	5.744	0.337	1.234	0.691	80	39 : 41
<i>Panel B: Non-TBTF banks</i>						
[-30;-11]	-8.719	4.782	-0.677	1.100	162	70 : 92
[-10;+10]	69.428	12.384	3.760***	3.963***	162	60 : 102
[-5;+5]	74.119	15.894	4.203***	4.816***	162	57 : 105
[-1;+1]	28.647	1.731	2.212**	2.031**	162	73 : 89
[0;0]	7.948	0.911	2.403**	2.126**	162	65 : 97
[-5;-1]	27.559	4.984	3.045***	2.871***	162	65 : 97
[+1;+5]	38.611	5.716	3.500***	4.228***	162	62 : 100
<i>Panel C: Difference between TBTF and non-TBTF banks</i>						
	Δ Mean CASC (bps)	Δ Median CASC (bps)	two sample <i>t</i> -test (<i>t</i> -value)	Mann Whitney U test (<i>Z</i> -Score)		
[-30;-11]	18.450	2.316	0.976	0.159		
[-10;+10]	-76.304	-11.380	-2.843***	-3.054***		
[-5;+5]	-71.366	-13.277	-2.799***	-3.321***		
[-1;+1]	-24.305	-0.921	-1.308	-0.879		
[0;0]	-6.555	-0.323	-1.360	-0.403		
[-5;-1]	-31.943	-4.996	-2.445**	-2.691***		
[+1;+5]	-32.867	-5.379	-2.048**	-2.371**		

Table 6: Regression results for rating downgrade announcements

This table shows the regression results for the sample of the 782 rating downgrades attributed to internal and external reasons. The dependent variable is bank i 's mean cumulative adjusted CDS spread change (CASC) either during the $[-10;+10]$ ($CASC_{i,[-10;+10]}$) or $[-5;+5]$ ($CASC_{i,[-5;+5]}$) day event window. *TBTF*, *TBTF1*, and *TBTF5* are binary variables equal to 1 if a bank was among the three largest, the largest, or among the five largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating change announcement, respectively, and 0 otherwise. *INTERNAL* is a binary variable that takes the value of 1 if the rating downgrade is due to internal reasons and 0 if the rating downgrade is due to external reasons. *RATING* is defined as the bank's rating prior to the rating downgrade on a 23 step numerical scale (AAA/Aaa=23, AA+/Aa1=22,..., C and lower=1), *NOTCHES* is defined as the absolute difference between the old and new rating based on the 23 step numerical scale, *REVIEW* is equal to 1 if the rating change was preceded by a rating review and 0 otherwise and *INVESTMENT TO NON-INVESTMENT DOWNGRADE* is equal to 1 if the rating downgrade resulted in a non-investment grade status of the bank (e.g. BBB-/Baa3 and above to BB+/Ba1 and below), and 0 otherwise. *S&P* and *FITCH* are both equal to 1 if the downgrade announcement was made by S&P or Fitch, respectively, and 0 otherwise, and *CRISIS* takes the value 1 if the event occurred between January 2008 and December 2009 and 0 otherwise. *OPAQUENESS* takes the value of 0 if the bank has a rating by S&P, Moody's and Fitch, 1 if the banks has a rating by only two of the three CRAs, and 2 if the bank is rated by only one CRA, *ROA* is defined as the bank's ROA in the year prior to the rating announcement, *LEVERAGE* is the ratio of total liabilities to total equity of the bank at the end of the year prior to event, *LIQUIDITY* is the ratio of non-zero daily CDS spread changes to the total number of trading days during the 120-day estimation period, and *LIABILITIES/GDP* is a binary variable equal to 1 if the ratio of the bank's total liabilities divided by the GDP of the bank's country of origin in the year prior to the event exceeds 0.5 and 0 otherwise, *GOVERNMENT* is a binary variable that takes the value of 1 if the bank is a policy bank or the government holds significant stake in the bank and 0 otherwise, *IB* is equal to 1 if the bank's first two digits of the SIC code start with 62 (e.g., investment banks and asset managers) and 0 otherwise, and *EU* is equal to 1 if the firm's headquarter is located in Europe and 0 otherwise. The standard errors are corrected for heteroskedasticity and given in parentheses. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable	$CASC_{i,[-10;+10]}$			$CASC_{i,[-5;+5]}$		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<u>TBTF-specific variables</u>						
<i>TBTF</i>	11.816 (11.940)			4.666 (8.782)		
<i>TBTF1</i>		26.320** (10.739)			11.124 (8.088)	
<i>TBTF5</i>			15.568 (13.205)			2.541 (9.447)
<i>TBTF x INTERNAL</i>	-68.259*** (20.301)	-87.225*** (19.918)	-65.584*** (22.557)	-60.770*** (16.461)	-64.012*** (15.579)	-55.581*** (17.937)
<u>Rating-specific variables</u>						
<i>INTERNAL</i>	71.377*** (17.906)	59.943*** (14.209)	78.063*** (21.404)	65.827*** (14.071)	53.819*** (11.109)	69.309*** (16.616)
<i>RATING</i>	-7.445** (2.927)	-7.496** (2.943)	-7.351** (2.897)	-7.050** (2.942)	-7.146** (2.966)	-6.934** (2.912)
<i>NOTCHES</i>	40.010** (15.866)	42.188** (15.968)	39.909** (15.849)	45.199*** (14.325)	47.104*** (14.497)	45.083*** (14.267)
<i>REVIEW</i>	-24.400** (11.282)	-24.045** (11.249)	-22.613** (11.235)	-12.510 (9.419)	-12.279 (9.420)	-10.631 (9.322)
<i>INVESTMENT TO NON-INVESTMENT DOWNGRADE</i>	6.381 (27.793)	6.243 (27.931)	6.239 (28.062)	-7.655 (23.550)	-8.284 (23.833)	-8.875 (23.823)
<u>Event-specific variables</u>						
<i>S&P</i>	-3.229 (15.307)	-1.445 (15.326)	-2.762 (15.283)	-4.179 (11.780)	-2.783 (11.819)	-3.977 (11.781)
<i>FITCH</i>	-16.318 (11.100)	-15.101 (11.110)	-15.286 (11.084)	-8.339 (9.209)	-7.612 (9.253)	-7.742 (9.227)
<i>CRISIS</i>	24.131 (16.447)	23.293 (16.690)	23.161 (16.259)	36.724** (14.929)	36.186** (15.116)	35.366** (14.778)
<u>Bank-specific variables</u>						
<i>OPAQUENESS</i>	-19.433 (12.610)	-18.971 (12.399)	-20.170 (12.555)	-12.692 (9.462)	-11.856 (9.223)	-13.905 (9.444)
<i>ROA</i>	-0.875 (3.291)	-0.867 (3.300)	-1.056 (3.293)	-2.285 (2.632)	-2.261 (2.641)	-2.361 (2.634)
<i>LEVERAGE</i>	0.030 (0.024)	0.033 (0.024)	0.028 (0.023)	0.027 (0.021)	0.031 (0.022)	0.020 (0.021)
<i>LIQUIDITY</i>	64.050 (50.825)	69.426 (50.516)	64.650 (50.698)	12.633 (34.712)	18.335 (34.046)	13.253 (34.337)
<i>LIABILITIES / GDP</i>	19.409 (12.988)	12.487 (11.574)	16.031 (12.201)	27.681** (10.986)	21.124** (9.666)	25.395** (10.089)
<i>GOVERNMENT</i>	-16.942 (14.220)	-16.314 (14.037)	-12.644 (13.885)	-6.436 (11.820)	-5.442 (11.687)	-1.600 (11.434)
<i>IB</i>	-16.159 (16.151)	-13.230 (15.988)	-16.102 (16.505)	-15.506 (11.441)	-12.636 (11.141)	-16.686 (11.652)
<i>EU</i>	-25.440* (14.141)	-26.352* (14.488)	-23.738* (13.872)	-26.772* (10.772)	-28.556* (11.166)	-24.482* (10.506)
<i>INTERCEPT</i>	82.672 (55.070)	81.832 (54.638)	75.064 (54.710)	70.463 (50.022)	70.772 (49.763)	67.155 (49.579)
N	782	782	782	782	782	782
Adjusted R ²	0.099	0.098	0.098	0.156	0.150	0.155
F-test	2.30***	2.53***	2.25***	2.23***	2.30***	2.13***

Table 7: Stock market reaction to rating downgrade announcements

This table shows the results for the short-term stock market reaction for the entire sample of 605 rating downgrade announcements (Panel A), divided into downgrade announcements due to internal reasons (Panel B) and external reasons (Panel C). Rating downgrade announcements due to internal reasons are further divided into TBTF (Panel D) and non-TBTF banks (Panel E). A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement. The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for stock price adjustments following the official announcement, respectively. The average and median cumulative abnormal returns (CAR) are shown in percentage and tested for significance using the parametric, variance-change corrected standardized cross-section test introduced by Boehmer Musumeci and Poulsen (1991), the BMP-test and the nonparametric rank test first introduced by Corrado (1989) and later refined by Corrado and Zivney (1992), the CZ-test. The equality of means and medians of rating downgrade announcements due to internal for TBTF and non-TBTF banks are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel F). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Average CAR	Median CAR	BMP-test (t-value)	CZ-test (Z-score)	N	neg:pos
<i>Panel A: All rating downgrade announcements</i>						
[-10;+10]	-0.74%	-0.91%	-1.314	-2.806***	606	326 : 280
[-5;+5]	-1.09%	-0.77%	-2.239**	-2.798***	606	335 : 271
[-1;+1]	-1.35%	-0.75%	-4.162***	-3.978***	606	360 : 246
[0;0]	-0.46%	-0.33%	-2.671***	-2.602***	606	339 : 267
[-5;-1]	-0.33%	-0.38%	-1.225	-1.580	606	327 : 279
[+1;+5]	-0.30%	-0.56%	-0.635	-1.406	606	333 : 273
<i>Panel B: Rating downgrade announcements due to internal reasons</i>						
[-10;+10]	-1.15%	-1.13%	-0.479	-0.795	156	89 : 67
[-5;+5]	-1.87%	-1.15%	-1.287	-1.519	156	89 : 67
[-1;+1]	-2.86%	-0.96%	-3.233***	-3.212***	156	94 : 62
[0;0]	-0.87%	-0.34%	-2.084**	-2.289**	156	89 : 67
[-5;-1]	-1.03%	-0.47%	-1.232	-2.064**	156	85 : 71
[+1;+5]	0.03%	-0.34%	0.304	0.835	156	79 : 77
<i>Panel C: Rating downgrade announcements due to external reasons</i>						
[-10;+10]	-0.38%	-0.89%	-0.948	-2.698***	450	236 : 214
[-5;+5]	-0.80%	-0.69%	-1.675*	-2.295**	450	245 : 205
[-1;+1]	-0.75%	-0.56%	-2.369**	-2.818***	450	262 : 188
[0;0]	-0.25%	-0.29%	-1.393	-1.761*	450	247 : 203
[-5;-1]	0.01%	-0.38%	-0.305	-0.728	450	241 : 209
[+1;+5]	-0.56%	-0.59%	-1.359	-1.887*	450	254 : 196
<i>Panel D: Rating downgrade announcements due to internal reasons TBTF banks</i>						
[-10;+10]	-1.09%	-2.47%	-0.014	0.108	64	39 : 25
[-5;+5]	-2.81%	-1.55%	-1.413	-2.171**	64	40 : 24
[-1;+1]	-3.13%	-1.30%	-2.224**	-1.621	64	41 : 23
[0;0]	-1.14%	-0.46%	-1.661*	-2.209**	64	41 : 23
[-5;-1]	-1.95%	-0.14%	-1.373	-2.216**	64	35 : 29
[+1;+5]	0.28%	-0.80%	0.260	-0.017	64	38 : 26
<i>Panel E: Rating downgrade announcements due to internal reasons non-TBTF banks</i>						
[-10;+10]	-2.25%	-0.62%	-1.046	-1.600	92	51 : 41
[-5;+5]	-1.32%	-0.84%	-0.751	-0.999	92	50 : 42
[-1;+1]	-3.05%	-0.94%	-2.817***	-3.914***	92	57 : 35
[0;0]	-0.98%	-0.27%	-1.939*	-1.905*	92	51 : 41
[-5;-1]	-0.87%	-0.80%	-0.863	-1.499	92	51 : 41
[+1;+5]	0.53%	0.92%	0.604	0.870	92	41 : 51
<i>Panel F: Difference between rating downgrade announcements due to internal reasons for TBTF and non-TBTF banks</i>						
	Δ ACAR	Δ Median CAR	two sample <i>t</i> -test (t-value)	Mann Whitney U test (Z-Score)		
[-10;+10]	1.16%	-1.85%	0.367	0.027		
[-5;+5]	-1.49%	-0.71%	-0.586	-0.261		
[-1;+1]	-0.08%	-0.36%	-0.044	-0.088		
[0;0]	-0.16%	-0.20%	-0.189	-0.218		
[-5;-1]	-1.08%	0.66%	-0.514	-0.099		
[+1;+5]	-0.25%	-1.72%	-0.131	-0.463		

Table 8: Bond market reaction to rating downgrade announcements

This table shows the results for the short-term bond market reaction for the entire sample of 524 rating downgrade announcements (Panel A), divided into downgrade announcements due to internal reasons (Panel B) and external reasons (Panel C). Rating downgrade announcements due to internal reasons are further divided into TBTF (Panel D) and non-TBTF banks (Panel E). A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement. The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for stock price adjustments following the official announcement, respectively. The average and median cumulative abnormal bond returns (CABR) are shown in percentage and tested for significance using the parametric *t*-test, and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating downgrade announcements due to internal for TBTF and non-TBTF banks are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel F). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CABR	Median CABR	<i>t</i> -test (<i>t</i> -value)	Wilcoxon (<i>Z</i> -score)	N	neg:pos
<i>Panel A: All rating downgrade announcements</i>						
[-10;+10]	-0.233%	-0.033%	-1.834*	-1.468	524	267 : 257
[-5;+5]	-0.301%	-0.070%	-3.256***	-3.223***	524	301 : 223
[-1;+1]	-0.218%	-0.026%	-3.528***	-2.923***	524	286 : 238
[0;0]	-0.081%	-0.013%	-2.731***	-3.318***	524	305 : 219
[-5;-1]	-0.149%	0.006%	-2.346**	0.300	524	259 : 265
[+1;+5]	-0.071%	-0.054%	-1.028	-3.647***	524	309 : 215
<i>Panel B: Rating downgrade announcements due to internal reasons</i>						
[-10;+10]	-0.956%	-0.171%	-3.314***	-2.898***	166	94 : 72
[-5;+5]	-0.796%	-0.126%	-3.831***	-3.189***	166	100 : 66
[-1;+1]	-0.372%	-0.027%	-2.324**	-1.794*	166	91 : 75
[0;0]	-0.054%	-0.010%	-0.952	-1.258	166	95 : 71
[-5;-1]	-0.369%	0.000%	-2.370**	-0.578	166	83 : 83
[+1;+5]	-0.373%	-0.076%	-3.068***	-2.318**	166	96 : 70
<i>Panel C: Rating downgrade announcements due to external reasons</i>						
[-10;+10]	0.102%	0.022%	0.807	0.226	358	173 : 185
[-5;+5]	-0.072%	-0.048%	-0.772	-1.700*	358	201 : 157
[-1;+1]	-0.146%	-0.022%	-2.850***	-2.292**	358	195 : 163
[0;0]	-0.094%	-0.016%	-2.703***	-3.191***	358	210 : 148
[-5;-1]	-0.047%	0.014%	-0.812	0.738	358	176 : 182
[+1;+5]	0.069%	-0.052%	0.835	-2.928***	358	213 : 145
<i>Panel D: Rating downgrade announcements due to internal reasons TBTF banks</i>						
[-10;+10]	-0.529%	-0.178%	-1.699*	-1.880*	69	40 : 29
[-5;+5]	-0.318%	0.012%	-1.321	-0.619	69	34 : 35
[-1;+1]	-0.045%	-0.017%	-0.576	-0.774	69	35 : 34
[0;0]	0.030%	-0.009%	0.982	0.182	69	39 : 30
[-5;-1]	-0.174%	0.084%	-0.845	1.169	69	30 : 39
[+1;+5]	-0.174%	-0.090%	-2.048**	-2.472**	69	43 : 26
<i>Panel E: Rating downgrade announcements due to internal reasons non-TBTF banks</i>						
[-10;+10]	-1.259%	-0.158%	-2.863***	-2.208**	97	54 : 43
[-5;+5]	-1.135%	-0.207%	-3.688***	-3.449***	97	66 : 31
[-1;+1]	-0.604%	-0.027%	-2.269**	-1.668*	97	56 : 41
[0;0]	-0.114%	-0.010%	-1.208	-1.628	97	56 : 41
[-5;-1]	-0.507%	-0.038%	-2.283**	-1.542	97	53 : 44
[+1;+5]	-0.514%	-0.035%	-2.594**	-1.268	97	53 : 44
<i>Panel F: Difference between rating downgrade announcements due to internal reasons for TBTF and non-TBTF banks</i>						
	Δ ACAR	Δ Median CAR	two sample <i>t</i> -test (<i>t</i> -value)	Mann Whitney U test (<i>Z</i> -Score)		
[-10;+10]	0.730%	-0.020%	1.249	0.167		
[-5;+5]	0.818%	0.219%	1.957*	2.117**		
[-1;+1]	0.559%	0.010%	1.731*	0.623		
[0;0]	0.144%	0.001%	1.255	1.350		
[-5;-1]	0.334%	0.122%	1.058	1.674*		
[+1;+5]	0.340%	-0.055%	1.381	-0.639		

Figure 1: Total number of bank rating change announcements and average bank rating

This figure shows the total number of bank rating change announcements during the investigation period from 1st January 2004 to 31st December 2015 on a quarterly basis. The data is based on 2,364 rating announcements that were collected for the 212 banks in the sample during the investigation period that possessed a long-term issuer rating by S&P, Moody's and/or Fitch. The figure also shows the average rating of the 212 sample banks during the entire investigation period.

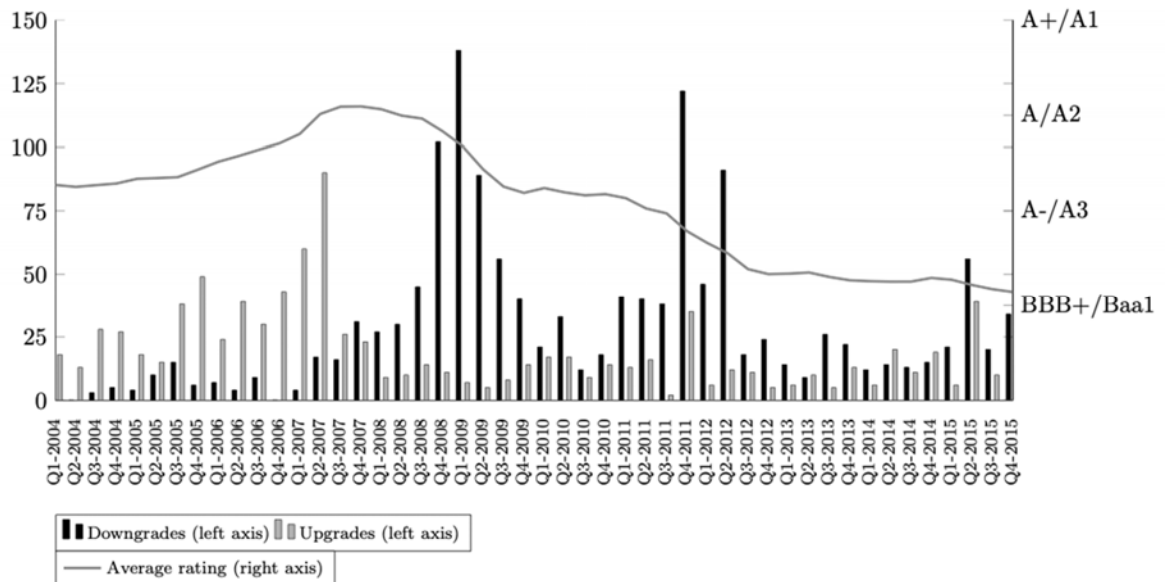
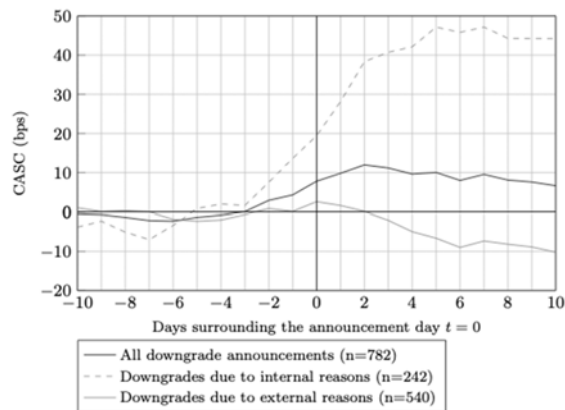


Figure 2: CDS spread development during the [-10;+10] day event window

This figure shows the mean cumulative adjusted CDS spread change (CASC) development in basis points (bps) for the entire sample of 782 rating downgrade announcements (Panel A) and 299 rating upgrade announcements (Panel B) during the [-10;+10] day event window surrounding the rating change announcement $t=0$. The rating downgrade and rating upgrade announcements are divided into announcements due to internal and external reasons.

Panel A: Rating downgrade announcements



Panel B: Rating upgrade announcements

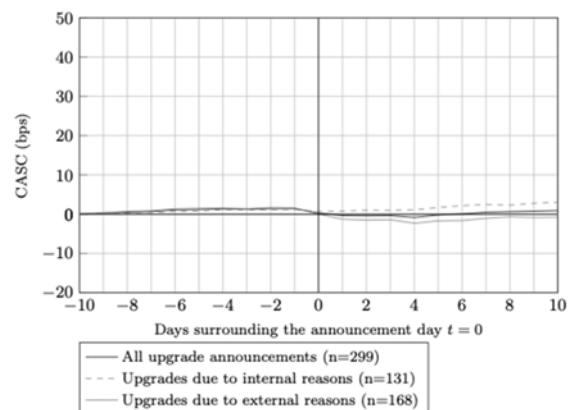
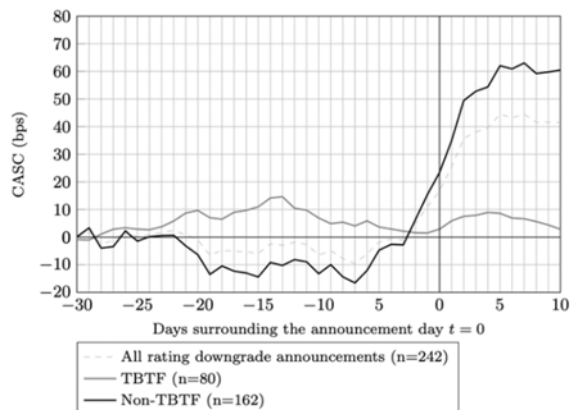


Figure 3: CDS spread development during the [-30;+10] day event window for TBTF and non-TBTF banks

This figure shows the mean cumulative adjusted CDS spread change (CASC) development in basis points (bps) for the sample of 242 rating downgrades attributed to internal reasons and 540 rating downgrades attributed to external reasons during the [-30;+10] day event window surrounding the rating change announcement $t=0$, divided into the CASC development for TBTF and non-TBTF banks. A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement.

Panel A: Internal downgrades



Panel B: External downgrades

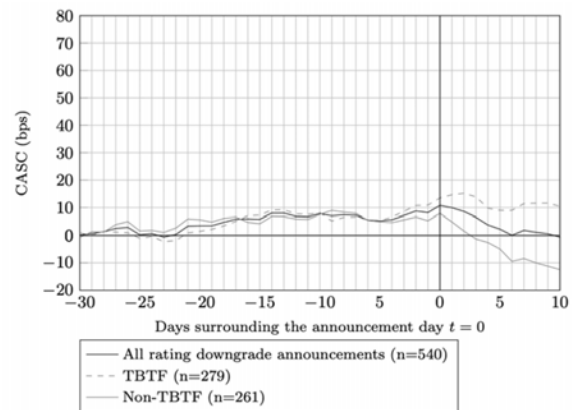
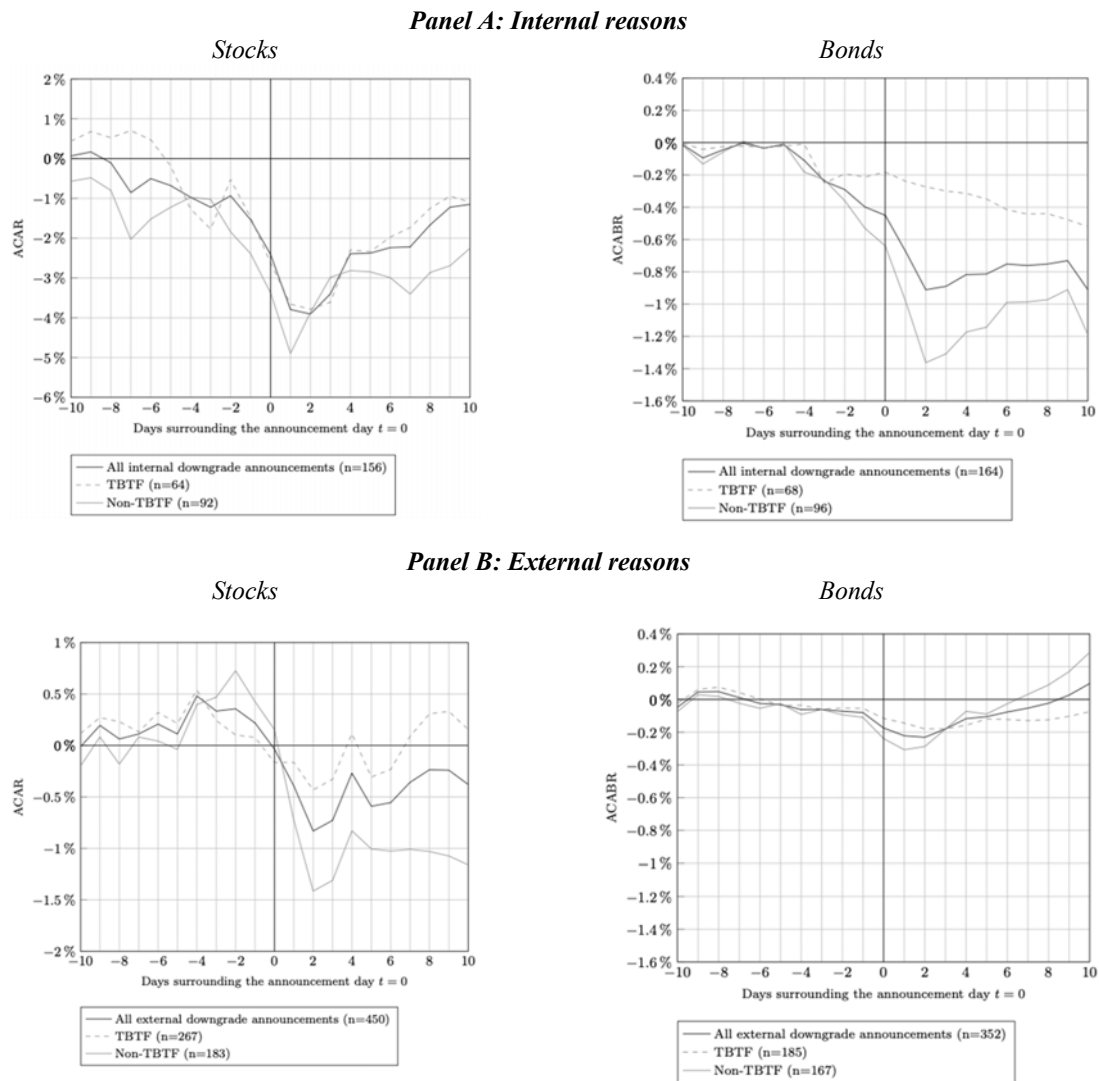


Figure 4: Development of the equity returns and bond returns around rating downgrade announcements

This figure shows the average cumulative abnormal return (ACAR) and the average cumulative abnormal bond return (ACABR) development in percent for the sample of 156 events for the stock event study and 164 events for the bond event study for rating downgrades attributed to internal reasons (Panel A) and 450 events for the stock event study and 352 events for the bond event study for rating downgrades attributed to external reasons (Panel B) during the $[-10; +10]$ day event window surrounding the rating change announcement $t=0$. Both samples are divided into the ACAR and ACABR development for TBTF and non-TBTF banks. A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement.



ONLINE APPENDIX

Market discipline through credit ratings and Too-Big-to-Fail in banking

Appendix A: Additional tables and figures

Table A.1: Years and country statistics

This table shows the distribution of events for the entire sample of 1,081 rating change announcements during the investigation period from January 2004 to December 2015 by country. Panel A shows the 782 rating downgrades by country and year and Panel B shows the 299 upgrades by country and year.

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
Panel A: Downgrades													
Austria					1	1		3	3	2	8	7	25
Bahrain						1							1
Belgium					2	3		2	2			1	10
Brazil										1	2	6	9
Canada						1				1			2
Denmark						4		3	2				9
France				1	12	4	2	14	12	5		2	52
Germany		1		1	4	2	2	5	4	4	3	7	33
Greece							17	24				3	44
India						1				1		2	4
Ireland					1	13	11	4		1		2	32
Italy		3			2	8	6	26	28	20	5	5	103
Japan				4	3	15	6	11	4		2	3	48
Kazakhstan										1		3	4
Netherlands				1	2	6	3	4	6	3	2	2	29
Norway						1			1				2
Portugal						3	6	12	4	1		1	27
Russian Federation					1	3				1	6	4	15
South Korea						5	1						6
Spain					2	9	2	21	29	2	2	1	68
Sweden				1		5			2				8
Switzerland				2	7	1		3	2			1	17
Tunisia										2			2
Turkey											4		4
United Arab Emirates						7							7
United Kingdom		1		4	7	14	2	9	7	2	2	8	56
United States	3	5		17	49	34		18	13	4	2	7	152
Total	3	10		31	93	141	58	167	124	52	38	65	782
Panel B: Upgrades													
Australia			2	9	3		1			1			16
Austria												2	2
Belgium			1	1							2		4
Brazil								3					3
Canada				1									1
Chile									1				1
China		2	1	2	1		2	1					9
Colombia											1		1
Denmark											2	1	3
France	1	1	5	4							1		12
Germany		2	1	4		2			2		1	4	16
Greece				1						4			5
Hong Kong				1									1
India	1	1	2	4		2		2					12
Ireland		1		3					1		1	3	9
Italy	1	1	9	9							2	4	26
Japan	3	1	1	2				2	1	2	2	2	16
Malaysia	1	1											2
Netherlands				2				1				1	4
Portugal			1	3							1		5
Russian Federation			3		2			2		2			9
Saudi Arabia							2						2
Singapore				1				2					3
South Korea		5	1	5			5	2	3	2	1	3	27
Spain			2	4	1						7	6	20
Sweden		1		1				1	1	1		4	9
Switzerland			1	2									3
Taiwan								1					1
Turkey						1	2		2	2			7
United Arab Emirates							1	1					2
United Kingdom	2		3	4	1		3	2			3	7	25
United States	1	4	14	11	2	1		2		2	1	5	43
Total	10	20	47	74	10	6	16	22	11	16	25	42	299

Table A.2: List of keywords

This table shows the keywords used to classify the rating announcements, divided into internal reasons (Panel A) and external reasons (Panel B). The internal reasons are further subdivided into capital structure, operating performance and M&A, while the external reasons are split into environment, sovereign, and methodology. The reason for a rating change by a CRA is identified using a keyword search in the corresponding press release. 76 keywords are used which are frequently mentioned as a reason and sorted in order of appearance in the press release. If more than one keyword appeared in a press release, the event is attributed to the first keyword, as it is assumed that the most important reason is mentioned first. In case a press release did not explicitly include one of the keywords, the reason is manually matched to the closest category.

Panel A: Internal reasons	
<i>Capital structure</i>	Balance sheet structure, capital structure, credit profile, debt reduction, financial policy, financial position, financial profile, financial risk, financial risk profile, financial structure, funding profile, leverage, parent guarantee, risk profile
<i>Operating performance</i>	Business portfolio, business risk, business risk profile, capital efficiency, cash flow generation, competition, competitiveness, demand, diversification, earnings, efficiency, growth potential, integration, liquidity, market position, operating environment, operating performance, products, profit margin, profitability, restructuring, retained earnings, revenues, sales, trading loss
<i>M&A reasons</i>	Acquire, acquiring, acquisition, bid, deal, M&A, merged, merger
Panel A: External reasons	
<i>Environment</i>	Condition, Dodd-Frank, economic downturn, environment, fundamental trends, law, market condition, market development, reform, regulation, regulatory, systemic risk
<i>Sovereign</i>	Authorities, propensity country, financial support, follows the downgrade, follows the revision of, follows the upgrade, government, likelihood of a downgrade, provide support, receive support from, sovereign
<i>Methodology</i>	Current criteria, JDA, methodology, rating criteria, revised bank criteria

Table A.3: CDS market reaction to rating downgrade announcements by reason

This table shows the results of the short-term CDS market reaction for the 782 rating downgrade announcements by the reason for the downgrade announcements. The reasons are divided into internal reasons and external reasons. The internal reasons include rating changes as a result of changes in capital structure (Panel A), operating performance (Panel B), or M&A activity (Panel C). External reasons include rating changes due to changes in the macroeconomic or regulatory environment (Panel D), adjustments to the sovereign rating (Panel E), and changes in the methodology the CRA uses to assess the ratings of banks (Panel F). The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (<i>t</i> -value)	Wilcoxon (<i>Z</i> -score)	N	neg:pos
Internal reasons						
<i>Panel A: Rating downgrade announcements due to capital structure reasons</i>						
[-10;+10]	36.925	2.351	1.750*	0.956	75	34 : 41
[-5;+5]	55.061	6.993	2.413**	1.732*	75	34 : 41
[-1;+1]	30.664	1.076	1.401	1.500	75	35 : 40
[0;0]	11.757	1.100	2.377**	2.735***	75	25 : 50
[-5;-1]	11.725	-0.521	0.970	0.026	75	39 : 36
[+1;+5]	31.579	2.760	2.324**	2.698***	75	30 : 45
<i>Panel B: Rating downgrade announcements due to operating performance reasons</i>						
[-10;+10]	51.650	8.022	2.819***	2.719***	145	60 : 85
[-5;+5]	51.609	8.174	3.138***	3.364***	145	56 : 89
[-1;+1]	16.226	1.203	1.766*	0.899	145	67 : 78
[0;0]	3.077	0.755	1.123	1.089	145	64 : 81
[-5;-1]	20.911	2.297	2.532**	2.054**	145	58 : 87
[+1;+5]	27.621	2.752	2.633***	2.602***	145	64 : 81
<i>Panel C: Rating downgrade announcements due to M&A reasons</i>						
[-10;+10]	19.938	20.350	1.722*	2.053**	22	5 : 17
[-5;+5]	27.936	9.656	2.204**	2.539**	22	4 : 18
[-1;+1]	15.258	4.170	1.726*	1.802*	22	7 : 15
[0;0]	3.229	0.412	1.085	0.860	22	9 : 13
[-5;-1]	9.203	3.853	2.201**	1.867*	22	8 : 14
[+1;+5]	15.505	3.632	1.638	1.899*	22	7 : 15
External reasons						
<i>Panel D: Rating downgrade announcements due to environment reasons</i>						
[-10;+10]	-17.292	-3.803	-2.118**	-2.592***	247	143 : 104
[-5;+5]	-8.742	-1.919	-1.889*	-2.034**	247	143 : 104
[-1;+1]	1.271	-1.319	0.458	-1.862*	247	148 : 99
[0;0]	1.378	-0.333	0.632	-1.750*	247	147 : 100
[-5;-1]	0.413	-0.312	0.147	-0.649	247	129 : 118
[+1;+5]	-10.533	0.438	-2.630***	-0.783	247	121 : 126
<i>Panel E: Rating downgrade announcements due to sovereign reasons</i>						
[-10;+10]	1.140	-2.786	0.149	-0.990	250	134 : 116
[-5;+5]	4.820	-1.502	0.891	-1.214	250	131 : 119
[-1;+1]	4.315	-0.333	1.421	0.363	250	130 : 120
[0;0]	4.468	-0.469	1.995**	-0.008	250	139 : 111
[-5;-1]	4.129	0.025	1.017	-0.533	250	124 : 126
[+1;+5]	-3.777	-2.654	-1.115	-2.007**	250	138 : 112
<i>Panel F: Rating downgrade announcements due to methodology changes</i>						
[-10;+10]	-35.307	-9.064	-3.138***	-3.224***	43	29 : 14
[-5;+5]	-38.203	-35.569	-6.082***	-4.951***	43	37 : 6
[-1;+1]	-22.803	-17.121	-5.776***	-4.637***	43	34 : 9
[0;0]	-2.993	-0.751	-1.898*	-1.823*	43	30 : 13
[-5;-1]	-2.027	-0.670	-0.324	0.302	43	22 : 21
[+1;+5]	-33.183	-16.984	-5.348***	-4.456***	43	36 : 7

Table A.4: CDS market reaction to rating upgrade announcements by reason

This table shows the results of the short-term CDS market reaction for the 299 rating upgrade announcements by the reason for the upgrade announcements. The reasons are divided into internal reasons and external reasons. The internal reasons include rating changes as a result of changes in capital structure (Panel A), operating performance (Panel B), or M&A activity (Panel C). External reasons include rating changes due to changes in the macroeconomic or regulatory environment (Panel D), adjustments to the sovereign rating (Panel E), and changes in the methodology the CRA uses to assess the ratings of banks (Panel F). The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating upgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (t-value)	Wilcoxon (Z-score)	N	neg:pos
Internal reasons						
<i>Panel A: Rating upgrade announcements due to capital structure reasons</i>						
[-10;+10]	2.137	0.390	1.089	1.032	35	13 : 22
[-5;+5]	0.241	0.228	0.136	0.459	35	16 : 19
[-1;+1]	-0.701	0.003	-0.814	-0.442	35	17 : 18
[0;0]	-0.840	0.001	-1.891*	-0.950	35	17 : 18
[-5;-1]	0.904	0.373	0.695	1.491	35	11 : 24
[+1;+5]	0.177	-0.007	0.137	-0.066	35	18 : 17
<i>Panel B: Rating upgrade announcements due to operating performance reasons</i>						
[-10;+10]	0.752	0.331	0.829	1.112	71	31 : 40
[-5;+5]	0.005	-0.028	0.008	-0.510	71	36 : 35
[-1;+1]	-0.364	-0.268	-1.012	-2.227**	71	47 : 24
[0;0]	-0.339	-0.177	-1.865*	-2.531**	71	46 : 25
[-5;-1]	0.025	0.070	0.054	0.223	71	35 : 36
[+1;+5]	0.319	-0.004	0.611	-0.123	71	36 : 35
<i>Panel C: Rating upgrade announcements due to M&A reasons</i>						
[-10;+10]	10.666	1.710	2.691**	2.328**	25	7 : 18
[-5;+5]	4.705	0.808	2.405**	2.031**	25	8 : 17
[-1;+1]	0.492	0.063	0.533	0.886	25	10 : 15
[0;0]	-0.579	-0.179	-1.080	-0.914	25	14 : 11
[-5;-1]	1.188	0.317	1.174	1.429	25	9 : 16
[+1;+5]	4.096	1.033	1.681	2.274**	25	8 : 17
External reasons						
<i>Panel D: Rating upgrade announcements due to environment reasons</i>						
[-10;+10]	4.258	3.800	2.410**	2.301**	15	5 : 10
[-5;+5]	1.879	1.543	2.103*	2.034**	15	5 : 10
[-1;+1]	-0.391	-0.519	-0.679	1.640	15	10 : 5
[0;0]	-0.281	-0.022	-1.226	-0.310	15	8 : 7
[-5;-1]	1.422	1.023	1.790*	2.970***	15	3 : 12
[+1;+5]	0.738	0.656	0.754	1.640	15	5 : 10
<i>Panel E: Rating upgrade announcements due to sovereign reasons</i>						
[-10;+10]	-3.975	-0.909	-1.362	-0.629	68	36 : 32
[-5;+5]	-5.608	-2.145	-2.247**	-2.078**	68	42 : 26
[-1;+1]	-5.881	-0.573	-2.183**	-1.897*	68	42 : 26
[0;0]	-2.636	-0.185	-1.575	-1.693*	68	38 : 30
[-5;-1]	0.279	0.347	0.278	0.327	68	32 : 36
[+1;+5]	-3.251	-0.537	-1.509	-0.935	68	39 : 29
<i>Panel F: Rating upgrade announcements due to methodology changes</i>						
[-10;+10]	0.933	-0.220	0.633	0.458	85	45 : 40
[-5;+5]	-1.912	-0.228	-1.770*	-1.854*	85	53 : 32
[-1;+1]	-1.052	-0.130	-1.220	-1.864*	85	48 : 37
[0;0]	-1.048	0.000	-1.506	-0.620	85	42 : 43
[-5;-1]	-0.028	0.063	-0.027	0.437	85	38 : 47
[+1;+5]	-0.835	-0.193	-1.231	-1.878*	85	52 : 33

Table A.5: CDS market reaction to rating downgrade announcements due to external reasons for TBTF and non-TBTF banks

This table shows the results of the short-term CDS market reaction for the sample of 540 rating downgrade announcements attributed to external reasons, divided into external announcements for TBTF banks (Panel A) and non-TBTF banks (Panel B). A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement. The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-30;+10], [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating upgrade announcements due to internal and external reasons are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel C). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (<i>t</i> -value)	Wilcoxon (<i>Z</i> -score)	N	neg:pos
<i>Panel A: TBTF banks</i>						
[-30;-11]	10.433	4.933	0.975	1.288	279	130 : 149
[-10;+10]	-1.235	-3.147	-0.206	-1.774*	279	158 : 121
[-5;+5]	1.178	-1.648	0.308	-1.833*	279	154 : 125
[-1;+1]	3.299	-1.775	1.343	-1.888*	279	166 : 113
[0;0]	2.383	-0.755	1.402	-1.959*	279	169 : 110
[-5;-1]	4.247	-0.162	1.476	-0.557	279	142 : 137
[+1;+5]	-5.453	-0.732	-2.107**	-1.703*	279	148 : 131
<i>Panel B: Non-TBTF banks</i>						
[-30;-11]	-12.414	4.923	-0.887	-0.684	261	126 : 135
[-10;+10]	-19.770	-6.584	-2.264**	-2.782***	261	148 : 113
[-5;+5]	-11.211	-6.663	-2.008**	-3.344***	261	157 : 104
[-1;+1]	-1.947	-0.525	-0.642	-1.332	261	146 : 115
[0;0]	2.544	-0.161	1.069	-0.417	261	146 : 115
[-5;-1]	-0.524	-0.165	-0.141	-0.387	261	132 : 129
[+1;+5]	-13.230	-1.866	-3.066***	-3.304***	261	147 : 114
<i>Panel C: Difference between TBTF and non-TBTF banks</i>						
	Δ Mean CASC (bps)	Δ Median CASC (bps)	two sample <i>t</i> -test (<i>t</i> -value)	Mann Whitney U test (<i>Z</i> -Score)		
[-30;-11]	22.847	0.009	1.307	1.261		
[-10;+10]	18.535	3.437	1.768*	1.101		
[-5;+5]	12.389	5.015	1.851*	1.596		
[-1;+1]	5.247	-1.250	1.352	-0.242		
[0;0]	-0.160	-0.594	-0.055	-1.187		
[-5;-1]	4.772	0.002	1.024	-0.053		
[+1;+5]	7.777	1.134	1.569	1.295		

Table A.6: Descriptive sample statistics for all rating downgrades

This table shows the descriptive statistics for variables used in the regression analysis in Table 6 for the sample of the 782 rating downgrades. *TBTF*, *TBTF1*, and *TBTF5* are binary variables defined as 1 if a bank was among the three largest, the largest, or among the five largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating change announcement, respectively, and 0 otherwise. *INTERNAL* is a binary variable that takes the value of 1 if the rating downgrade is due to internal reasons and 0 if the rating downgrade is due to external reasons. *RATING* is defined as the bank's rating prior to the rating downgrade on a 23 step numerical scale (AAA/Aaa=23, AA+/Aa1=22,..., C and lower=1), *NOTCHES* is defined as the absolute difference between the old and new rating based on the 23 step numerical scale, *REVIEW* is defined as 1 if the rating change was preceded by a rating review and 0 otherwise and *INVESTMENT TO NON-INVESTMENT DOWNGRADE* is equal to 1 if the rating downgrade resulted in a non-investment grade status of the bank (e.g. BBB-/Baa3 and above to BB+/Ba1 and below), and 0 otherwise. *S&P* and *FITCH* are both equal to 1 if the downgrade announcement was made by S&P or Fitch, respectively, and 0 otherwise, and *CRISIS* takes the value 1 if the event occurred between January 2008 and December 2009 and 0 otherwise. *OPAQUENESS* takes the value of 0 if the bank has a rating by S&P, Moody's and Fitch, 1 if the banks has a rating by only two of the three CRAs, and 2 if the bank is rated by only one CRA, *ROA* is defined as the bank's ROA in the year prior to the rating announcement, *LEVERAGE* is the ratio of total liabilities to total equity of the bank at the end of the year prior to event, *LIQUIDITY* is the ratio of non-zero daily CDS spread changes to the total number of trading days during the 120-day estimation period, and *LIABILITIES/GDP* is a binary variable equal to 1 if the ratio of the bank's total liabilities divided by the GDP of the bank's country of origin in the year prior to the event exceeds 0.5 and 0 otherwise, *GOVERNMENT* is a binary variable that takes the value of 1 if the bank is a policy bank or the government holds significant stake in the bank and 0 otherwise, *IB* is equal to 1 if the bank's first two digits of the SIC code start with 62 (e.g., investment banks and asset managers) and 0 otherwise, and *EU* is equal to 1 if the firm's headquarter is located in Europe and 0 otherwise.

	N	Mean	Median	Standard deviation	25% quantile	75% quantile
<u>TBTF-specific variables</u>						
<i>TBTF</i>	782	0.459	0.000	0.499	0.000	1.000
<i>TBTF1</i>	782	0.179	0.000	0.384	0.000	0.000
<i>TBTF5</i>	782	0.582	1.000	0.494	0.000	1.000
<u>Rating-specific variables</u>						
<i>INTERNAL</i>	782	0.309	0.000	0.463	0.000	1.000
<i>RATING</i>	782	17.537	18.000	3.047	16.000	20.000
<i>NOTCHES</i>	782	1.353	1.000	0.694	1.000	2.000
<i>REVIEW</i>	782	0.471	0.000	0.499	0.000	1.000
<i>INVESTMENT TO NON-INVESTMENT DOWNGRADE</i>	782	0.073	0.000	0.260	0.000	0.000
<u>Event-specific variables</u>						
<i>S&P</i>	782	0.347	0.000	0.476	0.000	1.000
<i>FITCH</i>	782	0.229	0.000	0.420	0.000	0.000
<i>CRISIS</i>	782	0.299	0.000	0.458	0.000	1.000
<u>Bank-specific variables</u>						
<i>OPAQUENESS</i>	782	0.157	0.000	0.423	0.000	0.000
<i>ROA</i>	782	0.023	0.322	2.680	-0.026	0.780
<i>LEVERAGE</i>	782	29.102	15.703	94.701	11.727	25.262
<i>LIQUIDITY</i>	782	0.112	0.071	0.114	0.035	0.135
<i>LIABILITIES / GDP</i>	782	0.252	0.000	0.434	0.000	1.000
<i>GOVERNMENT</i>	782	0.184	0.000	0.388	0.000	0.000
<i>IB</i>	782	0.095	0.000	0.293	0.000	0.000
<i>EU</i>	782	0.659	1.000	0.474	0.000	1.000

Table A.7: Regression results for rating downgrades due to internal reasons

This table shows the regression results for the sample of the 242 rating downgrades attributed to internal reasons. The dependent variable is bank i 's mean cumulative adjusted CDS spread change (CASC) either during the $[-10;+10]$ ($CASC_{i[-10;+10]}$) or $[-5;+5]$ ($CASC_{i[-5;+5]}$) day event window. *TBTF*, *TBTF1*, and *TBTF5* are binary variables equal to 1 if a bank was among the three largest, the largest, or among the five largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating change announcement, respectively, and 0 otherwise. *RATING* is defined as the bank's rating prior to the rating downgrade on a 23 step numerical scale (AAA/Aaa=23, AA+/Aa1=22,..., C and lower=1), *NOTCHES* is defined as the absolute difference between the old and new rating based on the 23 step numerical scale, *REVIEW* is equal to 1 if the rating change was preceded by a rating review and 0 otherwise, and *INVESTMENT TO NON-INVESTMENT DOWNGRADE* is equal to 1 if the rating downgrade resulted in a non-investment grade status of the bank (e.g. BBB-/Baa3 and above to BB+/Ba1 and below), and 0 otherwise. *M&A* and *CAPITAL STRUCTURE* are both equal to 1 if the reason for the rating downgrade announcement relate to M&A activity or changes to the bank's capital structure, respectively, and 0 otherwise, *S&P* and *FITCH* are both equal to 1 if the downgrade announcement was made by S&P or Fitch, respectively, and 0 otherwise, and *CRISIS* takes the value 1 if the event occurred between January 2008 and December 2009 and 0 otherwise. *OPAQUENESS* takes the value of 0 if the bank has a rating by S&P, Moody's and Fitch, 1 if the banks has a rating by only two of the three CRAs, and 2 if the bank is rated by only one CRA, *ROA* is defined as the bank's ROA in the year prior to the rating announcement, *LEVERAGE* is the ratio of total liabilities to total equity of the bank at the end of the year prior to event, *LIQUIDITY* is the ratio of non-zero daily CDS spread changes to the total number of trading days during the 120-day estimation period, and *LIABILITIES/GDP* is a binary variable equal to 1 if the ratio of the bank's total liabilities divided by the GDP of the bank's country of origin in the year prior to the event exceeds 0.5 and 0 otherwise, *GOVERNMENT* is a binary variable that takes the value of 1 if the bank is a policy bank or the government holds significant stake in the bank and 0 otherwise, *IB* is equal to 1 if the bank's first two digits of the SIC code start with 62 (e.g., investment banks and asset managers) and 0 otherwise, and *EU* is equal to 1 if the firm's headquarter is located in Europe and 0 otherwise. The standard errors are corrected for heteroskedasticity and given in parentheses. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Dependent variable	$CASC_{i[-10;+10]}$			$CASC_{i[-5;+5]}$		
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
TBTF-specific variables						
<i>TBTF</i>	-67.698*** (22.990)			-51.363** (21.354)		
<i>TBTF1</i>		-59.987*** (22.298)			-46.248** (20.435)	
<i>TBTF5</i>			-48.617** (22.360)			-37.585* (20.302)
Rating-specific variables						
<i>RATING</i>	-13.781** (6.304)	-13.980** (6.332)	-13.815** (6.334)	-15.103** (6.822)	-15.250** (6.844)	-15.121** (6.839)
<i>NOTCHES</i>	59.961 (48.868)	63.334 (48.942)	60.893 (49.207)	91.989** (40.492)	94.552** (40.716)	92.666** (40.795)
<i>REVIEW</i>	-54.129** (25.715)	-54.719** (25.814)	-50.664** (25.709)	-42.141* (24.127)	-42.595* (24.193)	-39.461 (23.985)
<i>INVESTMENT TO NON-INVESTMENT DOWNGRADE</i>	-28.660 (78.204)	-31.552 (79.135)	-32.376 (78.804)	-52.866 (64.084)	-55.073 (64.727)	-55.712 (64.543)
Event-specific variables						
<i>M&A</i>	1.926 (30.465)	-6.904 (29.449)	3.813 (30.050)	-3.487 (28.913)	-10.188 (28.244)	-1.903 (28.388)
<i>CAPITAL STRUCTURE</i>	-28.504 (28.362)	-30.827 (28.284)	-26.307 (29.037)	-7.617 (26.557)	-9.344 (26.498)	-5.843 (26.948)
<i>S&P</i>	9.856 (35.588)	14.100 (35.618)	10.538 (35.783)	-2.468 (29.432)	0.771 (29.409)	-1.980 (29.549)
<i>FITCH</i>	5.015 (21.826)	5.957 (22.091)	7.492 (21.837)	2.119 (22.633)	2.882 (22.863)	4.077 (22.826)
<i>CRISIS</i>	46.450 (27.590)	46.254 (27.579)	44.497 (27.386)	75.191*** (27.044)	75.050*** (26.969)	73.693*** (26.760)
Bank-specific variables						
<i>OPAQUENESS</i>	-20.095 (28.482)	-18.332 (29.500)	-23.114 (28.663)	-28.196 (23.639)	-26.869 (24.244)	-30.567 (23.847)
<i>ROA</i>	-2.848 (5.048)	-2.734 (5.069)	-3.008 (5.088)	-3.786 (4.167)	-3.700 (4.181)	-3.912 (4.187)
<i>LEVERAGE</i>	0.088** (0.037)	0.101** (0.039)	0.074* (0.040)	0.071 (0.045)	0.080 (0.044)	0.059 (0.046)
<i>LIQUIDITY</i>	-51.025 (114.573)	-33.274 (114.428)	-51.251 (114.689)	-5.010 (88.276)	8.507 (87.354)	-5.382 (87.758)
<i>LIABILITIES / GDP</i>	65.034** (32.159)	37.193 (27.055)	45.856 (29.210)	65.768** (30.146)	44.898* (25.517)	51.639* (27.485)
<i>GOVERNMENT</i>	-10.990 (24.909)	-5.660 (25.088)	1.695 (25.096)	0.019 (25.170)	4.029 (25.098)	9.709 (25.114)
<i>IB</i>	-44.091 (35.679)	-31.887 (37.167)	-44.625 (35.551)	-33.274 (29.096)	-23.876 (29.943)	-33.700 (28.998)
<i>EU</i>	-41.368 (28.721)	-44.730 (28.750)	-35.009 (28.789)	-48.764** (22.225)	-51.380** (22.298)	-43.876** (22.106)
<i>INTERCEPT</i>	260.055** (112.037)	248.239** (112.266)	254.818** (112.423)	219.992** (111.147)	210.978* (111.061)	216.056* (111.386)
N	242	242	242	242	242	242
Adjusted R ²	0.127	0.120	0.120	0.227	0.223	0.223
F-test	2.27***	1.91**	2.14***	1.99**	2.06***	2.00**

Table A.8: CDS market reaction to rating downgrade announcements using benchmark adjusted CDS spread changes

This table shows the results of the short-term CDS market reaction for the sample of 241 rating downgrade announcements attributed to internal reasons, divided into downgrade announcements for TBTF banks (Panel A) and non-TBTF banks (Panel B). A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement. The short-term event windows $[-10;+10]$, $[-5;+5]$, and $[-1;+1]$, as well as the announcement day $[0;0]$ are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the $[-30;-11]$, $[-5;-1]$ and $[+1;+5]$ day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The cumulative adjusted CDS spread changes are calculated by adding daily benchmark adjusted spread changes using $ASC_{i,t} = (CDS_{i,t} - CDS_{i,t-1}) - (I_t - I_{t-1})$, where $ASC_{i,t}$ is the adjusted CDS spread change of bank i on day t , $CDS_{i,t}$ is the observed CDS spread of bank i on day t and I_t is the relevant CDS spread index for the rating class on day t . The daily CDS spread index corresponds to the equally weighted cross-sectional mean of all CDS spreads for each of the six letter rating classes AAA/AA, A, BBB, BB, B, and CCC and below, composed of the CDS spreads of all financial institutions with available data through Thomson Reuters EOD and a long-term issuer rating of either S&P, Moody's, or Fitch, excluding the event firm. The mean and median CASC are shown in basis points (bps) and tested for significance using the parametric t -test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating downgrade announcements for TBTF and non-TBTF banks is tested for statistical significance using the two sample t -test and the Mann-Whitney U test (Panel C). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	t -test (t-value)	Wilcoxon (Z-score)	N	neg:pos
<i>Panel A: TBTF banks</i>						
$[-30;+10]$	6.130	4.095	1.629	2.317**	80	29 : 51
$[-10;+10]$	1.337	-0.217	0.245	-0.029	80	41 : 39
$[-5;+5]$	3.987	0.100	0.792	0.446	80	40 : 40
$[-1;+1]$	2.534	-0.021	1.075	0.249	80	40 : 40
$[0;0]$	0.308	0.384	0.332	0.964	80	36 : 44
$[-5;-1]$	-2.267	-0.173	-0.932	-0.408	80	42 : 38
$[+1;+5]$	5.946	0.305	1.619	1.525	80	36 : 44
<i>Panel B: Non-TBTF banks</i>						
$[-30;+10]$	9.213	4.379	0.372	1.933*	161	68 : 93
$[-10;+10]$	58.022	9.832	3.789***	4.087***	160	62 : 98
$[-5;+5]$	42.982	8.529	4.426***	4.499***	160	57 : 103
$[-1;+1]$	26.887	0.910	1.614	2.089**	160	76 : 84
$[0;0]$	2.439	0.511	1.368	1.419	160	65 : 95
$[-5;-1]$	29.025	4.444	3.576***	3.297***	161	63 : 98
$[+1;+5]$	11.178	0.785	1.773*	2.182**	160	76 : 84
<i>Panel C: Difference between TBTF and non-TBTF banks</i>						
	Δ Mean CASC (bps)	Δ Median CASC (bps)	two sample t-test (t-value)	Mann Whitney U test (Z-Score)		
$[-30;+10]$	-3.083	-0.285	-0.088	-0.244		
$[-10;+10]$	-56.685	-10.050	-2.575**	-2.698***		
$[-5;+5]$	-38.995	-8.429	-2.746***	-2.905***		
$[-1;+1]$	-24.353	-0.931	-1.030	-1.066		
$[0;0]$	-2.130	-0.127	-0.817	-0.251		
$[-5;-1]$	-31.293	-4.617	-2.685***	-2.599***		
$[+1;+5]$	-5.232	-0.480	-0.563	-0.196		

Table A.9: CDS market reaction to rating review for downgrade announcements

This table shows the results of the short-term CDS market reaction for the entire sample of 446 rating review for downgrade announcements (Panel A), divided into review announcements due to internal reasons (Panel B) and external reasons (Panel C). The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating review for downgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating review for downgrade announcements due to internal and external reasons are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel D). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (<i>t</i> -value)	Wilcoxon (<i>Z</i> -score)	N	neg:pos
<i>Panel A: All rating review for downgrade announcements</i>						
[-10;+10]	6.931	0.324	1.520	0.024	446	216 : 230
[-5;+5]	8.009	3.423	2.335**	2.118**	446	193 : 253
[-1;+1]	8.585	1.273	4.150***	4.092***	446	194 : 252
[0;0]	4.154	0.360	3.265***	4.397***	446	194 : 252
[-5;-1]	2.074	2.057	0.945	2.720***	446	193 : 253
[+1;+5]	1.781	-0.226	0.907	-0.404	446	232 : 214
<i>Panel B: Rating review for downgrade announcements due to internal reasons</i>						
[-10;+10]	19.163	11.582	2.542**	3.672***	145	50 : 95
[-5;+5]	18.554	9.729	3.121***	3.579	145	53 : 92
[-1;+1]	11.302	1.520	3.308***	3.025***	145	59 : 86
[0;0]	4.741	0.874	2.643***	3.090***	145	55 : 90
[-5;-1]	11.374	5.204	4.006***	4.533***	145	52 : 93
[+1;+5]	2.439	0.188	0.596	0.571	145	69 : 76
<i>Panel C: Rating review for downgrade announcements due to external reasons</i>						
[-10;+10]	1.039	-4.285	0.183	-2.553	301	166 : 135
[-5;+5]	2.929	1.111	0.702	0.081	301	140 : 161
[-1;+1]	7.276	1.149	2.814***	2.877***	301	135 : 166
[0;0]	3.872	0.183	2.309**	3.210***	301	139 : 162
[-5;-1]	-2.407	0.764	-0.825	0.299	301	141 : 160
[+1;+5]	1.464	-0.759	0.683	-0.915	301	163 : 138
<i>Panel D: Difference between rating review for downgrade announcements due to internal and external reasons</i>						
	Δ Mean CASC (bps)	Δ Median CASC (bps)	two sample <i>t</i> -test (<i>t</i> -value)	Mann Whitney U test (<i>Z</i> -Score)		
[-10;+10]	18.125	15.867	1.868*	4.462***		
[-5;+5]	15.625	8.619	2.142**	2.741***		
[-1;+1]	4.026	0.371	0.911	0.884		
[0;0]	0.869	0.690	0.320	0.882		
[-5;-1]	13.781	4.440	2.967***	3.084***		
[+1;+5]	0.975	0.946	0.232	0.947		

Table A.10: Subordinated CDS market reaction to rating downgrade announcements due to internal reasons for TBTF and non-TBTF banks

This table shows the results of the short-term CDS market reaction for the sample of 95 rating downgrade announcements attributed to internal reasons, divided into announcements for TBTF banks (Panel A) and non-TBTF banks (Panel B). A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement. The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted CDS spread changes (CASC) are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating downgrade announcements for TBTF and non-TBTF banks are tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (Panel C). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

Event window	Mean CASC (bps)	Median CASC (bps)	<i>t</i> -test (t-value)	Wilcoxon (Z-score)	N	neg:pos
<i>Panel A: TBTF banks</i>						
[-10;+10]	21.110	14.051	0.858	0.671	50	23 : 27
[-5;+5]	7.787	3.452	0.617	-0.053	50	24 : 26
[-1;+1]	3.232	2.649	0.536	0.574	50	21 : 29
[0;0]	-0.826	0.918	-0.336	0.092	50	22 : 28
[-5;-1]	-4.343	-0.519	-0.616	-0.661	50	26 : 24
[+1;+5]	12.956	0.870	1.608	0.352	50	24 : 26
<i>Panel B: Non-TBTF banks</i>						
[-10;+10]	98.318	25.450	2.995***	3.121***	45	15 : 30
[-5;+5]	68.566	25.822	3.617***	3.561***	45	16 : 29
[-1;+1]	14.214	1.369	2.164**	1.428	45	21 : 24
[0;0]	0.745	0.277	0.418	0.288	45	21 : 24
[-5;-1]	34.746	5.061	2.023**	2.918***	45	15 : 30
[+1;+5]	33.075	8.646	2.375**	2.500**	45	17 : 28
<i>Panel C: Difference between TBTF and non-TBTF banks</i>						
	Δ Mean CASC (bps)	Δ Median CASC (bps)	two sample t-test (t-value)	Mann Whitney U test (Z-Score)		
[-10;+10]	-77.208	-11.399	-1.905*	-2.106**		
[-5;+5]	-60.779	-22.370	-2.718***	-2.814***		
[-1;+1]	-10.982	1.280	-1.234	-0.786		
[0;0]	-1.571	0.641	-0.507	-0.183		
[-5;-1]	-39.089	-5.580	-2.184**	-2.426**		
[+1;+5]	-20.119	-7.776	-1.281	-1.793*		

Table A.11: Regression results for the interaction of TBTF variable with other rating-specific and bank-specific variables

This table shows the regression results for the interaction of the TBTF with other rating-specific and bank-specific variables for the sample of the 242 rating downgrades attributed to internal reasons. The dependent variable is bank i 's mean cumulative adjusted CDS spread change (CASC) during the $[-10; +10]$ (CASC _{$i, [-10; +10]$}) event window (Panel A) and the $[-5; +5]$ (CASC _{$i, [-5; +5]$}) day event window (Panel B). *TBTF* is a binary variable equal to 1 if a bank was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating change announcement and 0 otherwise. *BANKSIZE* is defined as the bank's total assets in billion U.S. dollars at the end of the year prior to the event, while *RATING* is defined as the bank's rating prior to the rating downgrade on a 23 step numerical scale (AAA/Aaa=23, AA+/Aa1=22,..., C and lower=1), *LIQUIDITY* is defined as the ratio of non-zero daily CDS spread changes to the total number of trading days during the 120-day estimation period, *SOVEREIGN RISK* is defined as GDP divided by total national debt of the bank's country of origin, and *CDS TRADER* is a binary variable equal to 1 if the bank was among the active CDS trader based on quotes submitted by dealers in Bloomberg subtracted by the mean number. All variables were standardized by deducting the mean value and dividing by the standard deviation of that variable. For binary variables, only the sample mean was deducted. The standard errors are corrected for heteroskedasticity and given in parentheses. *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
<i>Panel A: Dependent variable CASC_{$i, [-10; +10]$}</i>						
<i>TBTF</i>	-34.848* (17.916)	-60.659*** (17.222)	-78.471*** (19.987)	-74.721*** (20.046)	-73.040*** (19.130)	-52.889** (23.605)
<i>TBTF</i> × <i>BANKSIZE</i>	56.705* (31.072)					-11.031 (45.926)
<i>TBTF</i> × <i>RATING</i>		62.692** (26.457)				82.090** (38.996)
<i>TBTF</i> × <i>LIQUIDITY</i>			36.098** (16.795)			11.754 (19.878)
<i>TBTF</i> × <i>SOVEREIGN RISK</i>				14.193 (25.155)		32.694 (26.082)
<i>TBTF</i> × <i>CDS TRADER</i>					19.964 (30.384)	-9.194 (32.898)
<i>BANKSIZE</i>	-69.091** (30.315)					-8.061 (44.626)
<i>RATING</i>		-69.524*** (25.266)				-73.944** (36.967)
<i>LIQUIDITY</i>			-36.428** (15.548)			-9.779 (18.499)
<i>SOVEREIGN RISK</i>				-5.379 (23.675)		-27.055 (24.708)
<i>CDS TRADER</i>					-25.778 (26.739)	27.492 (29.569)
<i>INTERCEPT</i>	39.013*** (14.458)	56.379*** (15.166)	71.556*** (18.553)	70.111*** (18.586)	67.187*** (17.027)	58.398*** (21.080)
N	242	242	242	242	242	242
Adjusted R ²	0.034	0.100	0.045	0.022	0.021	0.087
F-test	6.46***	5.56***	5.79***	5.16***	6.45***	2.57***
<i>Panel B: Dependent variable CASC_{$i, [-5; +5]$}</i>						
<i>TBTF</i>	-39.258** (16.479)	-56.102*** (15.434)	-72.484*** (18.941)	-71.395*** (19.218)	-66.305*** (17.825)	-60.379** (23.728)
<i>TBTF</i> × <i>BANKSIZE</i>	47.763 (29.040)					-36.314 (53.443)
<i>TBTF</i> × <i>RATING</i>		68.533** (29.060)				92.657*** (43.325)
<i>TBTF</i> × <i>LIQUIDITY</i>			39.301*** (14.900)			7.453 (18.297)
<i>TBTF</i> × <i>SOVEREIGN RISK</i>				15.099 (19.584)		38.906* (21.347)
<i>TBTF</i> × <i>CDS TRADER</i>					32.724 (25.848)	13.315 (29.339)
<i>BANKSIZE</i>	-56.085* (28.557)					24.703 (52.594)
<i>RATING</i>		-72.761** (28.504)				-88.164** (42.148)
<i>LIQUIDITY</i>			-32.637** (13.923)			0.763 (17.190)
<i>SOVEREIGN RISK</i>				-10.182 (18.622)		-34.449* (20.464)

<i>CDS TRADER</i>					-41.151*	-4.672
					(23.527)	(27.477)
<i>INTERCEPT</i>	49.429***	60.462***	76.025***	75.412***	70.542***	72.371***
	(13.637)	(14.044)	(17.936)	(18.144)	(16.211)	(21.716)
N	242	242	242	242	242	242
Adjusted R ²	0.029	0.116	0.042	0.215	0.021	0.110
F-test	6.59***	5.44***	5.39***	5.02***	6.57***	2.54***

Table A.12: CDS market reaction to rating downgrade announcements for TBTF and non-TBTF banks for the time period prior to and following the official G-SIB designation

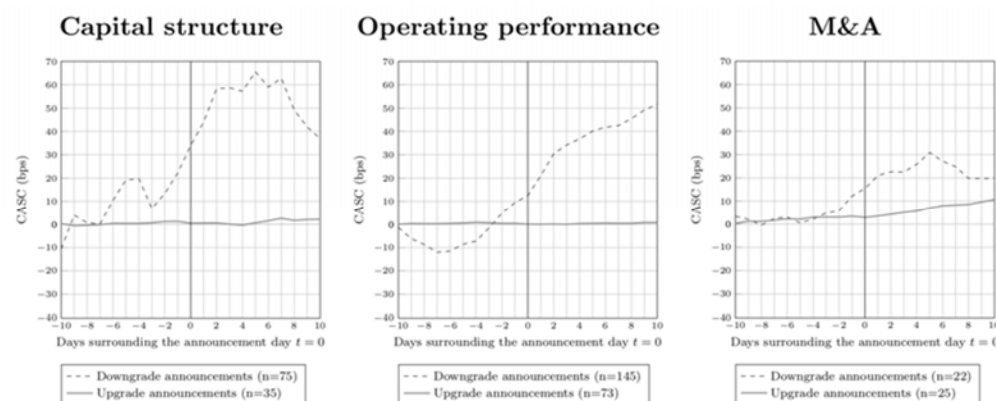
This table shows the results of the short-term CDS market reaction for the sample of 242 rating downgrade announcements attributed to internal reasons (Panel A), divided into downgrade announcements for TBTF banks (Panel B) and non-TBTF banks (Panel C). The sample is split into the time period prior to the official G-SIB announcement on 4 November 2011, the pre-G-SIB period, and the time period following the official announcement, the post-G-SIB period. A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement. The short-term event windows [-10;+10], [-5;+5], and [-1;+1], as well as the announcement day [0;0] are shown to capture the market reaction surrounding the rating downgrade announcement. In addition, the [-30;-11], [-5;-1] and [+1;+5] day event windows are shown to account for potential information leakage prior to the announcement and to account for adjustments to CDS spreads following the official announcement, respectively. The mean and median cumulative adjusted spread changes CASC are shown in basis points (bps) and tested for significance using the parametric *t*-test and the nonparametric Wilcoxon signed-rank test (Wilcoxon). The equality of means and medians of rating downgrade announcements during the pre-G-SIB period and post-G-SIB period is tested for statistical significance using the two sample *t*-test and the Mann-Whitney U test (MWU test). *, **, *** denote statistical significance at the 10%, 5%, and 1% level, respectively.

	Pre-G-SIB period						Post-G-SIB period						Delta			
	Mean CASC	Median CASC	<i>t</i> -test (t-value)	Wilcoxon (Z-score)	N	neg:pos	Mean CASC	Median CASC	<i>t</i> -test (t-value)	Wilcoxon (Z-score)	N	neg:pos	Δ Mean CASC	Δ Median CASC	<i>t</i> -test (t-value)	MWU test (Z-score)
<i>Panel A: All downgrades</i>																
[-30;-11]	-3.384	4.423	-0.290	1.475	180	78 : 102	-0.670	8.391	-0.085	1.490	62	25 : 37	-2.714	-3.968	-0.133	0.279
[-10;+10]	52.188	7.401	3.084***	2.364**	180	81 : 99	21.076	6.293	2.374**	3.144***	62	18 : 44	31.113	1.107	1.061	-0.262
[-5;+5]	62.971	9.096	3.915***	3.831***	180	69 : 111	14.427	5.702	2.084**	1.882*	62	25 : 37	48.544	3.394	1.750*	1.194
[-1;+1]	26.051	1.150	2.222***	1.570	180	85 : 95	4.830	1.467	2.076**	1.847*	62	24 : 38	21.221	-0.318	1.058	-0.214
[0;0]	7.368	1.028	2.431***	1.993**	180	78 : 102	1.178	0.548	1.323	2.079**	62	20 : 42	6.190	0.481	1.191	0.468
[-5;-1]	22.535	3.548	2.743***	1.991**	180	76 : 104	0.941	0.726	0.254	0.347	62	29 : 33	21.594	2.822	1.522	1.068
[+1;+5]	33.068	3.034	3.296***	3.223***	180	82 : 98	12.308	2.773	2.331**	3.123***	62	19 : 43	20.760	0.262	1.194	-0.073
<i>Panel B: TBTF banks</i>																
[-30;-11]	15.987	7.098	2.007**	1.847*	54	22 : 32	-3.319	5.038	-0.302	0.673	26	11 : 15	19.307	2.059	1.400	0.745
[-10;+10]	-14.213	-5.543	-1.412	-1.201	54	30 : 24	8.361	7.534	0.847	1.664*	26	9 : 17	-22.574	-13.076	-1.405	-1.433
[-5;+5]	1.915	4.081	0.228	0.133	54	24 : 30	4.494	-0.393	0.562	-0.038	26	13 : 13	-2.580	4.474	-0.193	0.149
[-1;+1]	4.060	0.563	0.930	0.142	54	26 : 28	4.928	1.121	1.355	1.181	26	10 : 16	-0.868	-0.558	-0.128	-0.704
[0;0]	0.626	0.680	0.312	0.607	54	25 : 29	2.987	0.557	2.023*	1.816*	26	8 : 18	-2.361	0.123	-0.769	-0.447
[-5;-1]	-2.014	0.483	-0.627	-0.530	54	26 : 28	-9.307	-0.452	-1.433	-0.927	26	14 : 12	7.293	0.934	1.130	0.673
[+1;+5]	3.303	-0.914	0.504	-0.504	54	31 : 28	10.815	2.098	2.403**	2.273**	26	8 : 18	-7.512	-3.012	-0.754	-2.060**
<i>Panel C: Non-TBTF banks</i>																
[-30;-11]	-11.686	3.766	-0.718	0.662	126	56 : 70	1.243	8.834	0.112	1.304	36	14 : 22	-12.929	-5.068	-0.416	-0.195
[-10;+10]	80.646	22.920	3.452***	3.322***	126	51 : 75	30.258	6.031	2.251**	2.828**	36	9 : 27	50.387	16.889	1.135	0.353
[-5;+5]	89.138	26.768	3.993***	4.304***	126	45 : 81	21.601	8.686	2.085**	2.545**	36	12 : 12	67.537	18.082	1.600	1.223
[-1;+1]	35.476	1.731	2.138**	1.689*	126	59 : 67	4.760	1.819	1.550	1.398	36	14 : 22	30.716	-0.088	0.986	0.175
[0;0]	10.257	1.121	2.428**	1.956*	126	53 : 73	-0.129	0.476	-0.121	1.115	36	12 : 24	10.386	0.645	1.308	0.856
[-5;-1]	33.056	6.905	2.863***	2.506**	126	50 : 76	8.342	1.861	2.105**	1.178	36	15 : 21	24.714	5.043	1.136	0.699
[+1;+5]	45.825	8.417	3.292***	3.838***	126	51 : 75	13.387	2.773	1.565	2.168**	36	11 : 25	32.438	5.644	1.224	1.029

Figure A.1: CDS spread development during the $[-10; +10]$ day event window by reason

This figure shows the mean CDS development in bps for the entire sample of 782 rating downgrade announcements and 299 rating upgrade announcements during the $[-10; +10]$ day event window surrounding the rating change announcement $t = 0$ by reason of the rating change announcement. The rating downgrade and rating upgrade announcements are divided announcements due to internal reasons (Panel A), and external reasons (Panel B). The internal reasons include rating changes as a result of changes in capital structure, operating performance, or M&A activity. External reasons include rating changes due to changes in the macroeconomic or regulatory environment, adjustments to the sovereign rating, and changes in the methodology the CRA uses to assess the ratings of banks.

Panel A: Internal reasons



Panel B: External reasons

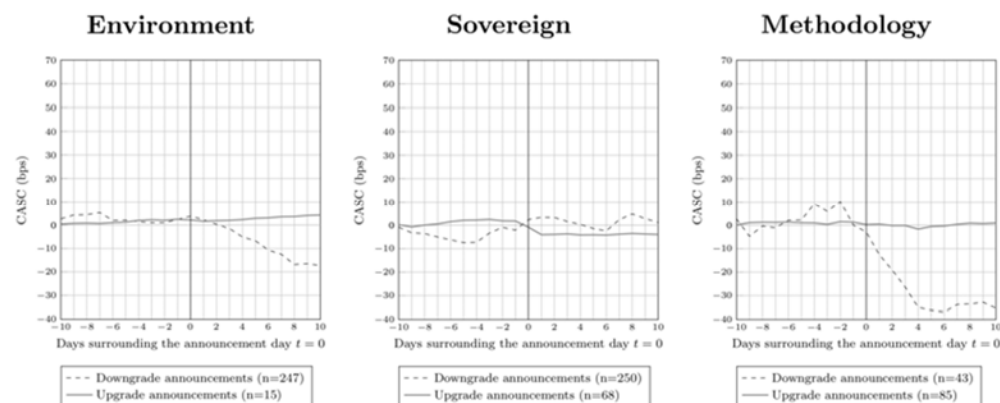


Figure A.2: CDS spread development during the [-10;+10] for TBTF and non-TBTF banks by region or country

This figure shows the mean cumulative adjusted CDS spread change (CASC) development in basis points (bps) for the sample of 242 rating downgrades attributed to internal reasons during the [-10;+10] day event window surrounding the rating change announcement $t=0$, split by region (Asia and Europa) and country (United States, United Kingdom, France, Germany, Italy, the Netherlands) and divided into the CASC development for TBTF and non-TBTF banks. A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement.

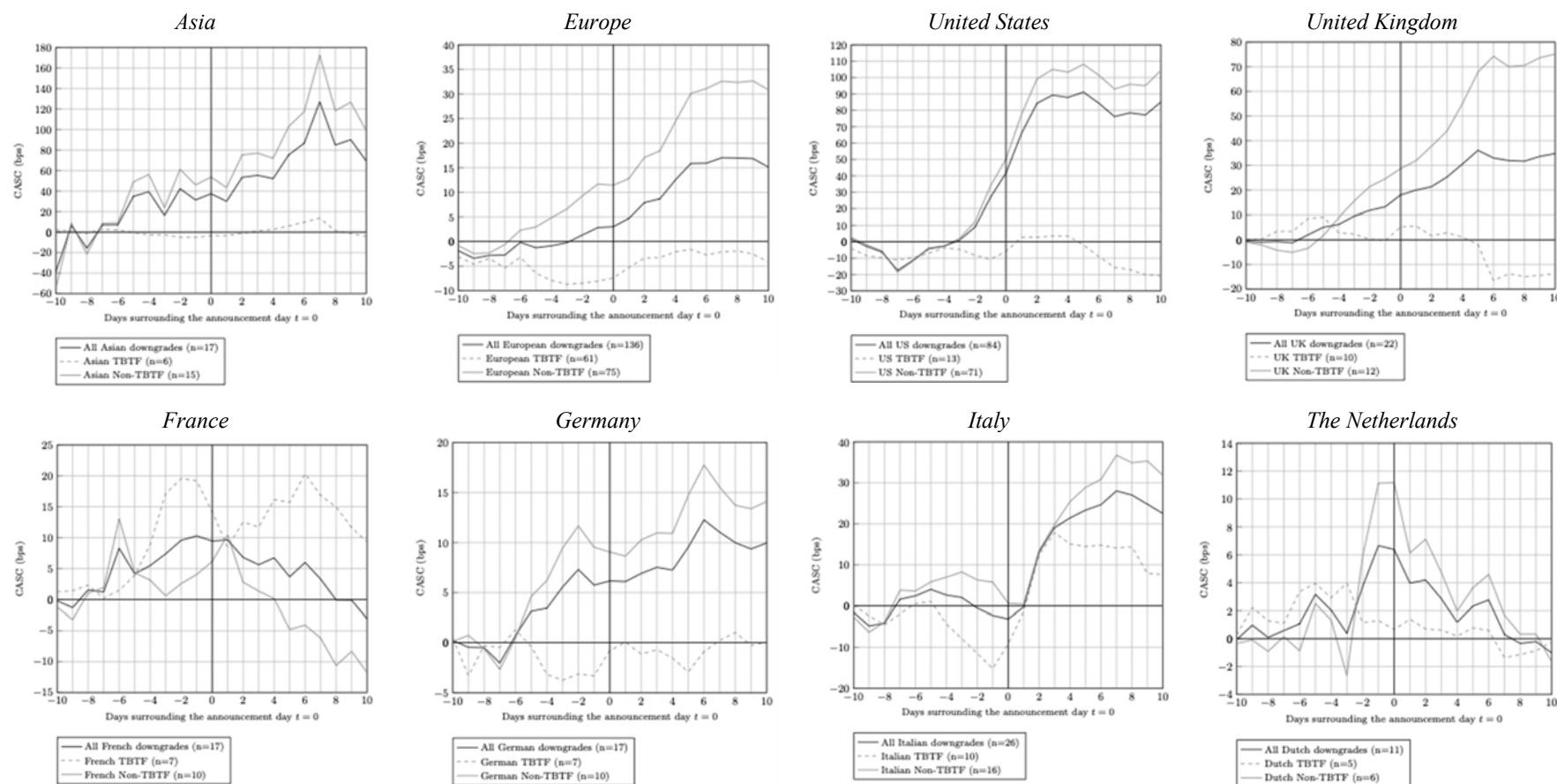
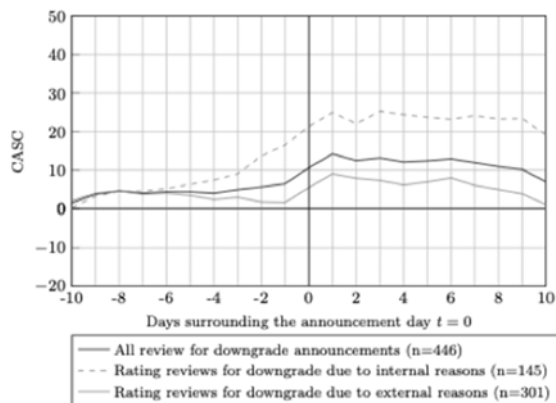


Figure A.3: CDS spread development for rating review announcements during the $[-10; +10]$ day event window

This figure shows the mean cumulative adjusted CDS spread change (CASC) development in basis points (bps) for the entire sample of 446 rating review for downgrade announcements (Panel A) and 87 rating review for upgrade announcements (Panel B) during the $[-10; +10]$ day event window surrounding the rating change announcement $t=0$. The rating review for downgrade and rating review for upgrade announcements are divided announcements due to internal reasons, and external reasons.

Panel A: Review for downgrade announcements



Panel B: Review for upgrade announcements

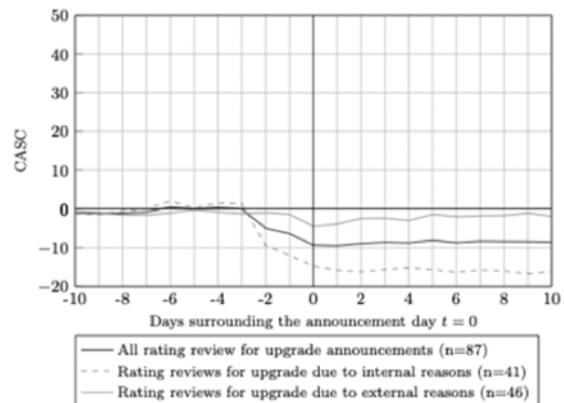


Figure A.4: CDS spread development during different time periods

This figure shows the mean cumulative adjusted CDS spread change (CASC) development in basis points (bps) for the sample of 242 rating downgrade announcements divided into three different time periods: (i) prior to the financial crisis from 2004 to 2008 (pre-crisis period; Panel A), (ii) during the financial crisis from 2008 to 2009 (crisis period; Panel B) and (iii) following the financial crisis from 2010 to 2015 (post-crisis period; Panel C) during the [-10;+10] day event window surrounding the rating change announcement $t=0$. The samples are further divided into TBTF and non-TBTF banks. A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement.

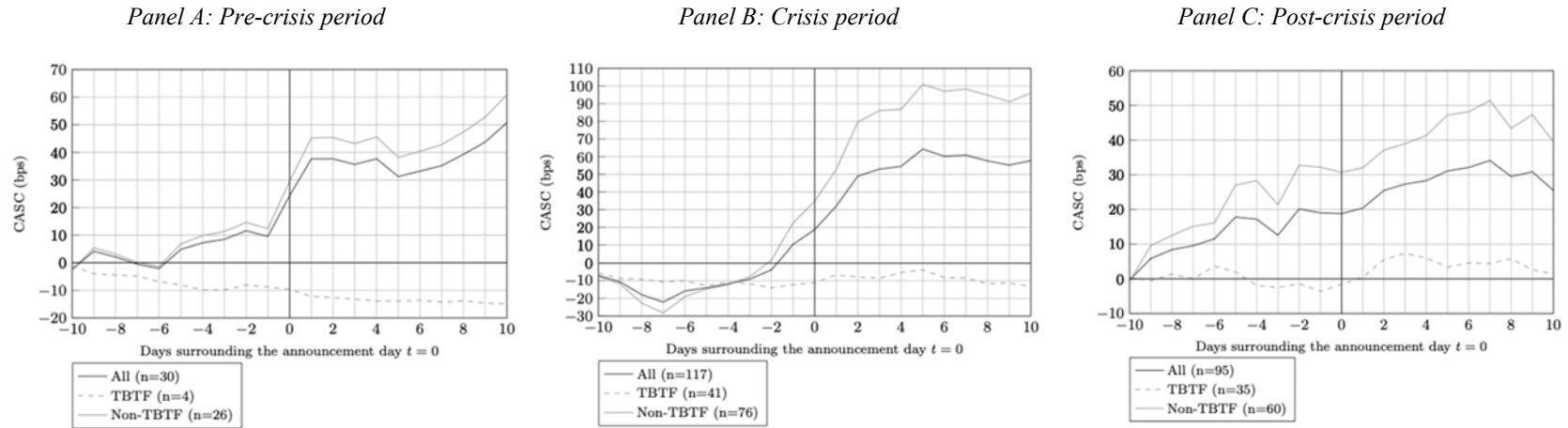
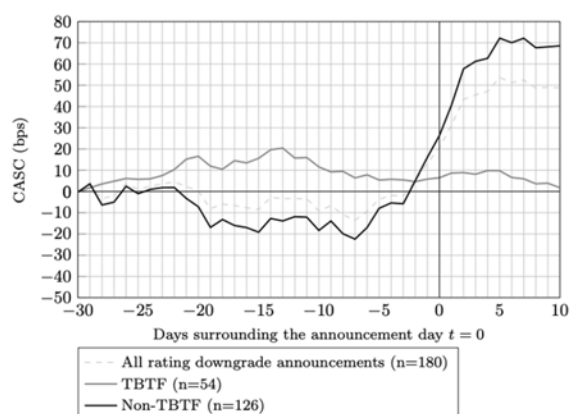


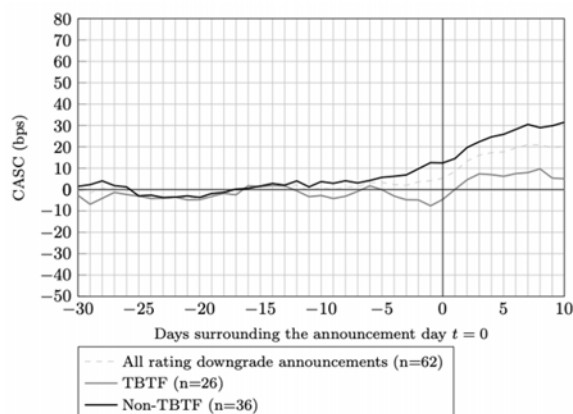
Figure A.5: CDS spread development during the [-30;+10] day event window before and after the official G-SIB announcement

This figure shows the mean cumulative adjusted CDS spread change (CASC) development in basis points (bps) for the sample of 180 rating downgrade announcements prior to the official announcement of the G-SIB on 4 November 2011, the pre-G-SIB period (Panel A), and for the sample of 62 rating downgrade announcements following the official announcement, the post-G-SIB period (Panel B), during the [-30;+10] day event window surrounding the rating change announcement $t=0$. The samples are further split into TBTF and non-TBTF banks. A bank is defined as TBTF if it was among the three largest banks in its country of origin as measured by the total assets at the end of the year prior to the rating downgrade announcement.

Panel A: Pre-G-SIB period



Panel B: Post-G-SIB period



Appendix B: Description of the stock and bond study methodology

This section provides a brief overview of the methodology used for the bond and stock event study described in section 5.1. The stock event study follows the approach as originally described by Dodd and Warner (1983) and Brown and Warner (1985) where average cumulative abnormal returns (ACARs) for event i in an event window $[\tau_1; \tau_2]$ surrounding the announcement day $t=0$ are calculated by:

$$ACAR_{i, [\tau_1; \tau_2]} = \frac{1}{N} \sum_{i=1}^N \sum_{t=\tau_1}^{\tau_2} (R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{m,it})) \quad (B.1)$$

where R_{it} is the actually realized return of event bank i on day t , $R_{m,it}$ is bank i 's home country Datastream benchmark index, $\hat{\alpha}_i$ and $\hat{\beta}_i$ are the regression estimates from an OLS of the form $R_{it} = \alpha_i + \beta_i R_{m,it} + \varepsilon_{it}$ using 252 trading day estimation period until $t=-11$, ε_{it} is the error term and N the number of events. To test whether ACARs differ significantly from 0, we use the parametric, variance-change corrected standardized cross-section test introduced by Boehmer, Musumeci and Poulsen (1991), the BMP-test and the nonparametric rank test first introduced by Corrado (1989) and later refined by Corrado and Zivney (1992), the CZ-test. The difference between two samples are tested using the two sample t -test and the Mann-Whitney U test.

Abnormal bond returns (ABRs) for bond j are calculated by

$$ABR_{jt} = BR_{jt} - BR_{MP,jt} \quad (B.2)$$

where BR_{jt} is bond j 's return on day t and $BR_{MP,jt}$ is the return matching benchmark portfolio of bonds. We construct daily portfolios of more than 10,000 liquid bonds available from Datastream from 2004 to 2015, split by rating (AAA/AA, A, BBB, BB, B, and CCC or below) and time to maturity tertile (short, medium, long) for a total of 18 portfolios. We use the value-weighted matched sum of the portfolio bond returns as this is considered the most appropriate approach

(Bessembinder, Kahle, Maxwell, and Xu, 2009). All bond returns of event bank i are condensed into one abnormal bond return using the valued-weighted sum of all ABRs belonging to that bank for event i , using $ABR_{CP,it} = \frac{\sum_j MV_{jt} ABR_{jt} \delta_{ij}}{\sum_j MV_{jt} \delta_{ij}}$, where MV_{jt} is bond j 's market value as of market closing on day t and δ_{ij} binary variable equal to 1 if bond j can be matched to the bank assigned to event i , and 0 otherwise, resulting in a market-value weighted portfolio. The average cumulative abnormal bond returns (ACABR) during the event window $[\tau_1; \tau_2]$ surrounding the announcement day $t=0$ are calculated by:

$$ACABR_{CP,i} [\tau_1; \tau_2] = \frac{1}{N} \sum_{i=1}^N \sum_{t=\tau_1}^{\tau_2} ABR_{CP,it} \quad (B.3)$$

where N is the number of events. To test whether ACABRs differ significantly from 0, we use the parametric t -test as well as the nonparametric Wilcoxon signed-rank test. The difference between two samples are tested using the two sample t -test and the Mann-Whitney U test.

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Appendix C: Literature on the existence of TBTF

This appendix briefly summarizes and describes the most prominent empirical studies on TBTF.¹ One of the first studies is by O'Hara and Shaw (1990), who show that there was a largely positive equity market reaction to the acknowledgment by the U.S. Comptroller of the Currency in 1984 that the U.S. regulators would not let the largest 11 banks fail. More recently, Moenninghoff, Ongena and Wieandt (2015) likewise document positive short-term equity market reactions for banks identified in a leaked list of the Financial Stability Board (FSB) as being Globally Systemically Important Banks (G-SIBs), which are banks whose failure would lead to severe instability in the global financial system. Therefore, these banks are essentially TBTF, as they are expected to receive government bailouts to avert a financial crisis. Bongini, Nieri and Pelagatti (2015) likewise find an overall positive equity market reaction to the release of the G-SIB methodology by the FSB on 19 July 2011 for G-SIBs, particularly for European ones. However, following this initial positive reaction, the market reaction turns mostly negative to subsequent FSB announcements as the regulation started to take shape and the full regulatory burden became apparent. Nonetheless, TBTF assumptions appear to exist in stock markets, as Gandhi and Lustig (2015) document size anomalies in the stock returns of U.S. banks, which are in line with the expectation that the shareholders of the largest banks will be protected through implicit government guarantees. Evidence for TBTF can also be found in the options market. Kelly, Lustig and Van Nieuwerburgh (2016) show that financial sector equity investors in the U.S. benefited from government guarantees in the form of a financial sector crash insurance worth up to 282 billion U.S. dollars during the financial crisis between 2007 and 2009.

¹ For an overview of the research on TBTF see also Strahan (2013).

There may also be other benefits from being perceived as TBTF. The chairman of HSBC acknowledged prior to the official G-SIB designation that the banks that are officially considered to be of systemic importance would likely have a more concentrated flow of business to them (Financial Times, 2011b). The Bank of China even viewed its designation as a G-SIB as offering the bank an advantage over its domestic peers (Financial Times, 2011a). Moreover, besides obtaining more business, benefits of being considered TBTF may be particularly pronounced in debt and credit markets. Here, banks potentially benefit from their TBTF status and obtain more favorable refinancing rates. To this end, the then CEO of Deutsche Bank, Josef Ackermann, stated that he was glad that Deutsche Bank would likely be considered a G-SIB, as this would lead to benefits with regard to its refinancing and depository business (Handelsblatt, 2011). It may therefore well be that the perception of being a large, systemically important bank will lead to a comparative advantage for these institutions, particularly in debt markets with respect to refinancing and funding operations.

In case TBTF banks possess a funding advantage over their non-TBTF banks, this may indicate that debt markets do not impose an adequate level of market discipline on large banks. The early studies of Avery, Belton and Goldberg (1988) and Hannan and Hanweck (1988) point in this direction, as the rates paid on insured certificates of deposit had little relation to risk measures of banks and the yields of certificates of deposit issued by larger banks were generally lower than the yields of those issued by smaller banks during the 1980s. During the early 1990s, however, investors started to exert some market discipline as the yields on subordinated debentures of financial institutions increased with higher levels of risk (Flannery and Sorescu, 1996). Similarly, Morgan and Stiroh (2005) document that the bond ratings of the 11 U.S. financial institutions that were considered TBTF following the testimony of the U.S. Comptroller of the Currency in 1984 were

able to issue new debt at significantly lower rates than other banks. There are also indications that the costs financial institutions associate with market discipline are lower than the costs they associate with regulatory discipline (Billett, Garfinkel and O'Neal, 1998).²

Rime (2005) finds that TBTF considerations significantly lift a bank's issuer rating, in some cases resulting in a bonus of several rating notches. This rating bonus significantly reduces a bank's refinancing and funding costs, effectively giving these banks a competitive advantage over their smaller peers. In a similar vein, Ueda and Weder di Mauro (2013) find that the funding advantage of TBTF banks was around 60 bps over their smaller peers at the end of 2007. By the end of 2009 and in the wake of the financial crisis, this advantage increased to 80 bps. This provides evidence that TBTF considerations undermine the effect of market discipline (Rime, 2005). Acharya, Anginer and Warburton (2016) document that bond credit spreads are not sensitive to risk for large financial institutions, while the spreads are sensitive to risk for smaller institutions and non-financial sector companies. This effectively shows that bondholders of large financial institutions anticipate government bailouts in case of a bank failure, while simultaneously allowing large banks to refinance and fund themselves at subsidized rates. As such, empirical research shows that TBTF considerations exist, not only in equity, but also in debt markets. Yet, there are also potential downsides for a bank to be considered TBTF, such as higher regulatory scrutiny and increased regulatory requirements.³

² Other prominent issues with respect to TBTF are the existence of moral hazard issues (Gropp, Gruendl and Guettler, 2014) and the inability of governments to credibly announce a no bailout policy (Gormley, Johnson and Rhee, 2015). In addition, the existence of a TBTF policy leads to distortions in the incentives for mergers and acquisitions (M&As) among banks, as equity and bond market participants generally view mergers that result in a TBTF banks positively (Penas and Unal, 2004; Ongena and Penas, 2009; Brewer and Jagtiani, 2013).

³ G-SIBs, for example, have higher required levels of Common Equity Tier 1, and are required to have group-wide resolution planning and regular resolvability assessments.

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